UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

July 21, 2003

Magalie Roman Salas
Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

RE: Endangered Species Act Section 7(a)(2) Formal Consultation and Magnuson-Stevens Act Essential Fish Habitat Consultation Regarding Spillway Modifications at Trail Bridge Dam, and Continued Operations of the Carmen-Smith Hydroelectric Project (FERC No. 2242, NOAA Fisheries Consultation No. 2003/00074)

Dear Secretary Salas:

Enclosed is the final biological opinion prepared by the National Marine Fisheries Service (NOAA Fisheries) on the effects of the Federal Energy Regulatory Commission's (FERC) proposed action at Eugene Water & Electric Board's (EWEB) Carmen-Smith Hydroelectric Project, including continued operations, conservation measures, and modification of the Trail Bridge Dam Emergency Spillway. This document represents NOAA Fisheries' biological opinion on the effects of the proposed action on listed species in accordance with Section 7(a)(2) of the Endangered Species Act as amended (16 USC 1531 *et seq.*). This biological opinion is also being provided to EWEB as FERC's designated non-Federal representative.

NOAA Fisheries prepared this biological opinion in response to your January 3, 2003, request for formal consultation. In this biological opinion, NOAA Fisheries determined that the proposed action is not likely to jeopardize the continued existence of Upper Willamette River chinook salmon. A complete administrative record of this consultation is on file with the NOAA Fisheries Hydropower Division in Portland, Oregon.

In addition to the biological opinion, enclosed as Chapter 13 is a consultation regarding essential fish habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). NOAA Fisheries finds that the proposed action will adversely affect EFH for chinook salmon and recommends that the Terms and Conditions in Chapter 9 of the biological opinion (in addition to EWEB's proposed conservation measures in Chapter 3) be adopted as EFH conservation measures. Pursuant to MSA (§305(b)(4)(B) and 50 CFR 6000.920(j), Federal agencies are required to provide a written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations.

Please direct comments or questions regarding this biological opinion and MSA consultation to Mindy Simmons of the NOAA Fisheries Hydropower Division at 503-872-2854.

Sincerely,

Brian J. Brown
for D. Robert Lohn
Regional Administrator

cc: FERC Service List
Laurie Power, EWEB

**U.S. DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
**Office of General Counsel, GCNW**
**7600 Sand Point Way N.E.,**
**Seattle, Washington 98115-6349**

July 21, 2003

The Honorable Magalie Salas
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Subject: Carmen-Smith Hydropower Project (FERC No. 2242) Endangered Species Act Biological Opinion and Essential Fish Habitat Consultation regarding spillway modifications at Trail Bridge Dam, and continuing operation of the Carmen-Smith Hydroelectric Project (Project No. 2242, NOAA Fisheries Consultation No. 2003/00074).

Dear Secretary Salas:

Enclosed for filing please find the original and eight (8) copies of the National Marine Fisheries Service's Biological Opinion and Essential Fish Habitat Consultation for the above-referenced actions; and Certificate of Service.

Sincerely,

Jane Hannuksela

Jane Hannuksela
Attorney Adviser
(206) 526-6515

Enclosures

**UNITED STATES OF AMERICA**
**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| **Eugene Water and Electric Board** | ) | |
| | ) | **Project No. 2242** |
| | ) | |
| | ) | **Carmen-Smith Project** |
| **Biological Opinion and Essential Fish Habitat Consultation** | ) | |
| | ) | |

## CERTIFICATE OF SERVICE

I hereby certify that I have this day served, by first class mail, the National Marine Fisheries Service's Biological Opinion and Essential Fish Habitat Consultation regarding spillway modifications at Trail Bridge, and continuing operations of the Carmen-Smith Hydroelectric Project, transmittal letter to Secretary Salas, cover letter to Secretary Salas, and this Certificate of Service upon each person designated on the official service list compiled by the Commission in the above captioned proceeding.

Dated this 21st day of July, 2003.

Jane Hannuksela

Jane Hannuksela

Attorney Adviser

Endangered Species Act
Section 7 (a)(2) Consultation

# BIOLOGICAL OPINION

and

# MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT CONSULTATION

on the Effects of EWEB's Carmen-Smith Part 12 Submittal to FERC for Trail Bridge Dam Emergency Spillway Expansion, and Continued Operation of the Carmen-Smith Hydroelectric Project in the McKenzie Subbasin, Oregon on:

Upper Willamette River chinook salmon

| | |
|---|---|
| Action Agency: | Federal Energy Regulatory Commission |
| Log Number: | F/NWR/2003/00074 |
| Consultation Conducted By: | NOAA Fisheries<br>Northwest Region<br>Hydropower Division |
| Date Issued: | July 21, 2003 |

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# 1. OBJECTIVES

## *1.1 Introduction*

The Endangered Species Act (ESA) (16 U.S.C. 1544 et seq.), establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NOAA Fisheries) (jointly "the Services"), as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitats.

On January 8, 2003, NOAA Fisheries received a request for formal ESA Section 7 (a)(2) consultation from the Federal Energy Regulatory Commission (FERC) for the proposed expansion of the Trail Bridge Dam spillway and the continued operation of the Carmen-Smith-Trail Bridge Hydroelectric Project (Carmen-Smith Project) under its existing license. The January 8, 2003, letter stated that the continued operation of the Carmen-Smith Project would be likely to adversely affect anadromous salmonid fish listed under the ESA. The Eugene Water & Electric Board (EWEB) owns and operates the Carmen-Smith Project under a license issued by FERC (FERC Project No. 2242). By letters dated June 24, 1999, and October 8, 1999, FERC designated EWEB as a non-Federal representative for the purpose of preparing a biological assessment (BA). A BA dated December 20, 2002, accompanied the January 8, 2003 request for formal consultation.

The objective of this biological opinion (Opinion) is to determine whether the proposed action is likely to jeopardize the continued existence of Upper Willamette River (UWR) chinook salmon.

## *1.2 Application of ESA Section 7(a)(2) Standards – Jeopardy Analysis Framework*

The standards for determining jeopardy and destruction or adverse modification of critical habitat are set forth in Section 7(a)(2) of the ESA and 50 CFR §402.02 (the consultation regulations). In conducting analyses of habitat-altering actions under Section 7 of the ESA, NOAA Fisheries uses the following steps of the consultation regulations combined with the Habitat Approach (NMFS 1999): 1) consider the biological requirements and status of the species (Section 1.2.1 and Chapter 4); 2) evaluate the relevance of the environmental baseline in the action area to the species' current status (Chapter 5); 3) determine the effects of the proposed or continuing action on the species and on any designated critical habitat, and whether the action is consistent with the available recovery strategy (Chapter 6); 4) consider cumulative effects (Chapter 7); and 5) determine whether the proposed action, in light of the above factors, is likely to jeopardize the continued existence of species survival or to modify or destroy designated critical habitat (Chapter 8). In completing step 5, NOAA Fisheries determines whether the action under consultation, together with all cumulative effects, when added to the environmental baseline, is likely to jeopardize the ESA listed species. If jeopardy is found, NOAA Fisheries will identify reasonable and prudent alternatives (RPA) for the action that avoid jeopardy.

Recovery planning will help identify measures to help conserve listed salmonids and increase their survival at each life stage.

### *1.2.1 Biological Requirements*

The first step NOAA Fisheries uses when applying the ESA Section 7(a)(2) to the listed evolutionarily significant units (ESU) considered in this Opinion is to define the species' biological requirements. Biological requirements are defined as successful adult, holding, spawning, incubation, rearing, and growth and development, and the habitat needed to support each stage. Biological requirements within the action area are a subset of the range-wide biological requirements of the ESU.

Identification of the range-wide biological requirements provides context for subsequent evaluation of action area biological requirements. Biological requirements must be met for the listed ESUs to survive and recover to naturally reproducing population sizes, at which protection under the ESA would become unnecessary. This will occur when populations are large enough to safeguard the genetic diversity of the listed ESUs, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment. McElhany et al. (2000) describe the attributes of viable salmonid populations, which are the components of ESUs, as adequate abundance, productivity (population growth rate), spatial scale, and diversity. These attributes are influenced by survival, behavior, and experiences throughout the entire life cycle.

NOAA Fisheries has convened several geographically-defined technical recovery teams to describe the number and type of populations that define viable ESUs and the habitat characteristics that support them. The Willamette/Lower Columbia Technical Recovery Team (W/LC TRT) has published its "Interim Report on Viability Criteria for Willamette and Lower Columbia Basin Pacific Salmonids" (2003). Viability criteria are quantitative and/or qualitative descriptions of recovered populations and the habitat characteristics that ensure their persistence over time. The technical recovery teams, in collaboration with co-managers and the W/LC recovery planning policy forum, are in the process of defining specific viability criteria. Until these are available, NOAA Fisheries uses the guidelines for establishing viability criteria described in W/LC TRT (2003) to assess the status of each ESU:

*Guidelines for Establishing Population-Level Viability Criteria*

- <u>Abundance/productivity</u>: viable populations should demonstrate a combination of abundance (population size) and productivity (population growth rate) that produces an acceptable probability that the population will persist (a population with a non-negative growth rate and an average abundance that approximates a credible estimate of historical

abundance would be in the highest persistence category).
- Juvenile outmigrant production: should be stable or increasing.
- Within-population spatial structure: the spatial structure of a population must support the population at the desired productivity, abundance, and diversity levels through short-term environmental disturbances, longer-term fluctuations, and natural disturbance regimes.
- Within-population diversity: must be sufficient to sustain a population through short-term environmental disturbances and to provide for long-term evolutionary processes based on maintaining a substantial proportion of the historical life-history traits.
- Habitat: diversity of habitats for viable populations should resemble historical conditions given natural disturbance regimes; distribution and capacity of habitat should be sufficient to maintain viable populations.

Viable ESUs are made up of a number of viable populations. Therefore, the W/LC TRT (2003) also developed guidelines for determining how many and which populations must meet the population viability criteria for an ESU to be viable:

*Guidelines for Establishing ESU-Level Viability Criteria*
- The individual populations in an ESU should have high enough persistence probabilities to ensure the persistence of the ESU.
- The populations restored/maintained at viable status or above should include:
  - "Core" populations (the most productive populations, historically).
  - "Genetic legacy" populations (with relatively unmodified historical gene pools).
  - Those with minimal susceptibility to catastrophic events.
- For ESUs with more than one life history and ecoregion combination (e.g., Lower Columbia River chinook salmon and Lower Columbia River steelhead), every stratum that historically existed should have a high probability of persistence.

For the purposes of this consultation, and until superceded by determinations of the W/LC TRT, NOAA Fisheries assumes that the viability of all the extant listed populations in the action area will be necessary for the viability and recovery of their respective ESUs.

As described in NOAA Fisheries' Habitat Approach (NMFS 1999), there is a strong causal link between habitat modification and the response of salmonid populations. Those links are often difficult to quantify. In many cases, NOAA Fisheries must describe biological requirements in terms of habitat conditions in order to infer the populations' response to the effects of the action. To survive and recover, a wide-ranging salmonid ESU must have adequate habitat available to support life-stage specific survival rates.

Properly functioning habitat would support successful adult holding, spawning, incubation, rearing, and growth and development. NOAA Fisheries typically considers the status of habitat variables in a matrix of pathways and indicators (MPI) (NMFS 1996), which was developed to describe properly functioning condition in forested montane watersheds. In this consultation, the majority of the action area consists of montane watersheds, but the action area also extends into the lower McKenzie River Valley. NOAA Fisheries developed a matrix similar to the existing MPI that can be used in the lower elevation valley as well as the montane watershed. Important habitat elements in the modified matrix are: flow and hydrology; riparian vegetation and floodplain function; large wood, sediment transport, and channel complexity; water quality, and safe passage, potentially including access to historical habitat.

##### *1.2.1.1 Status of Species*

NOAA Fisheries considers the current status of the listed species, taking into account population size, productivity, population spatial structure, and diversity. To assess the current status of the listed species within the action area, NOAA Fisheries starts with the determinations made in its decision to list for ESA protection the ESUs considered in this Opinion and also considers any new data that is relevant to the determination. The general life history, status, factors for decline, and population dynamics are described in Chapter 4 for the listed ESU.

### *1.2.2 Environmental Baseline*

The environmental baseline includes "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, including the anticipated impacts of all proposed Federal projects in the action area that have undergone Section 7 consultation and the impacts of state and private actions that are contemporaneous with the consultation in progress" (50 CFR §402.02). In step 2 of the analysis, NOAA Fisheries evaluates the relevance of the environmental baseline in the action area to the species' current status. In describing the environmental baseline, NOAA Fisheries emphasizes important habitat indicators for the listed salmonid ESU affected by the proposed action. The action area is described in section 3.4 of this document. NOAA Fisheries does not expect any other areas to be directly or indirectly affected by the proposed action.

The reason for determining the status of the species' biological requirements under the environmental baseline is to better understand the relative significance of the effects of the proposed action upon the species' likelihood of survival and chances for recovery. Thus, it is more likely that any additional adverse effects caused by the proposed or continuing action will be significant if the species status is poor and the baseline is degraded at the time of the consultation (NMFS 1996).

In Chapter 5, NOAA Fisheries describes properly functioning condition for each habitat characteristic, the current (baseline) condition relative to properly functioning condition, and the source of the baseline condition. The latter information differentiates conditions under the

baseline that are under the control of the action agencies from those that are under the control of other entities.

### *1.2.3 Analysis of Effects of the Proposed Action*

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR §402.02). Direct effects occur at the Project site and may extend upstream or downstream based on the potential for impairing important habitat elements. Indirect effects are defined in 50 CFR §402.02 as "those that are caused by the proposed action and are later in time, but still are reasonably certain to occur." They include the effects on listed species of future activities that are induced by the proposed action and that occur after the action is completed. "Interrelated actions are those that are part of a larger action and depend on the larger action for their justification" (50 CFR §403.02). "Interdependent actions are those that have no independent utility apart from the action under consideration" (50 CFR §402.02).

#### *1.2.3.1 Methods of Analysis*

In step 3 of the jeopardy analysis, NOAA Fisheries evaluates the effects of proposed actions on listed salmon and steelhead in the context of whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action. If a proposed action is likely to impair properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat toward properly functioning condition, it cannot be found to be consistent with conserving the species.

NOAA Fisheries may use either or both of two independent techniques (which are based on the ESA implementation regulations and the Habitat Approach) in determining whether the proposed action jeopardizes a species' continued existence (NMFS 1999). First, NOAA Fisheries may consider the impact in terms of how many listed salmon will be killed or injured during a particular life stage and then gauge the effects of that take on population size and viability. Alternatively, NOAA Fisheries may consider the effect on the species freshwater habitat requirements, such as water temperature, streamflow, etc. The habitat approach is based on well-documented cause and effect relationships between habitat quantity and quality, and population viability. While the habitat approach to the jeopardy analysis does not quantify the number of fish adversely affected by habitat alteration, it compares existing habitat conditions to those known to be conducive to salmon conservation (Spence et al. 1996). In other words, it analyzes the effect of the action on habitat functions that are important to meet salmonid life cycle needs. The habitat approach then links any impairment or loss of habitat function to an effect on the population and to the ESU as a whole. For this consultation, NOAA Fisheries utilizes the habitat approach to evaluate the effects of the proposed action on habitat characteristics.

### *1.2.4 Cumulative Effects*

The cumulative effects analysis is the last step or factor that NOAA Fisheries considers in formulating the biological opinion, as a way of taking into consideration the effect of future actions on the listed species' ability to survive and recover. As in its consideration of the effects of the environmental baseline, NOAA Fisheries focuses on the likely resulting conditions for the species in the action area relative to the biological requirements. Cumulative effects include effects of future State or private activities, not involving a Federal action, that are reasonably certain to occur within the action area under consideration. Past and present effects of non-Federal actions are part of the environmental baseline. Indicators of actions "reasonably certain to occur" may include, but are not limited to: approval of the action by State, tribal, or local agencies or governments (e.g., permits, grants); indications by State, tribal, or local agencies or governments that granting authority for the action is imminent; a project sponsor's assurance that the action will proceed; obligation of venture capital; or initiation of contracts (USFWS and NMFS 1998). The more State, tribal, or local administrative discretion remaining to be exercised before a proposed non-Federal action can proceed, the less reasonable certainty the project will be authorized. Speculative non-Federal actions that may never be implemented are not factored into the "cumulative effects" analysis. At the same time, "reasonably certain to occur" does not require a guarantee that the action will occur. There may be economic, administrative, and legal hurdles remaining before the action proceeds.

### *1.2.5 Conclusion*

The conclusion section presents NOAA Fisheries' opinion regarding whether the aggregate effects of the factors analyzed under "environmental baseline," "effects of the action," and "cumulative effects" in the action area – when viewed against the rangewide status of the species or the status of critical habitat as it was listed or designated – are likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of critical habitat. This conclusion is based on NOAA Fisheries' determination that the proposed action is or is not likely to improve or remove the factors that limit the viability of each ESU so that biological requirements are met. If NOAA Fisheries determines that the proposed action is likely to jeopardize listed species, it will identify RPAs for the action that avoid these effects and satisfy the species' biological requirements.

# 2. BACKGROUND

## *2.1 Consultation History*

On August 30, 1999, NOAA Fisheries sent FERC a letter requesting that FERC initiate consultation on the effects of relicensing EWEB's Leaburg-Walterville Project to the UWR ESU of spring chinook salmon (*Oncorhynchus tshawytscha*). By letter dated October 8, 1999, FERC designated EWEB as the non-Federal representative for consultation on effects of EWEB's three McKenzie River projects: Leaburg-Walterville Project, Carmen-Smith Project, and the licensed, but not yet constructed, Blue River Project, on spring chinook salmon and bull trout.

Discussions continued through 2000, with EWEB holding monthly coordination meetings to receive the Services and FERC assistance and input on the BA as it was developed. EWEB filed the draft BA with FERC on December 21, 2000, and FERC forwarded the BA (FERC 2001), with no changes, to the Services on February 14, 2001. During development of the draft biological opinion, the parties concluded that issuance of a biological opinion that included all three of EWEB's licensed projects could delay FERC approval of: 1) Leaburg-Walterville Project revised and updated license articles; 2) the related offer of settlement and settlement agreement between EWEB and the Services; and 3) the issuance of the biological opinion on the Leaburg-Walterville Project license proceeding. In order to avoid potential construction delays, the parties involved in the consultation agreed to withdraw the Carmen-Smith and Blue River project components of the proposed action, instead issuing a biological opinion only on the proposed action for the Leaburg-Walterville Project. The Services subsequently issued a joint biological opinion (NMFS and USFWS 2001) on the proposed relicensing of the Leaburg-Walterville Project to FERC on September 6, 2001, and FERC approved the revised and updated license articles by order dated December 18, 2001.

Following the release of the Leaburg Walterville Biological Opinion, the Services, FERC, and EWEB staff met on November 15, 2001, to discuss how best to complete ESA consultation on EWEB's remaining two FERC-licensed projects in the McKenzie subbasin: Carmen-Smith and Blue River. Several parties expressed uncertainty at the meeting regarding whether FERC intended to request formal Section 7(a)(2) consultation, although FERC had issued the 2001 BA to the Services that included all three of EWEB's projects in the McKenzie River subbasin.

In a letter dated December 21, 2001, NOAA Fisheries requested clarification from FERC on the intent of its consultation request for the Leaburg-Walterville, Carmen-Smith, and Blue River projects. The FERC responded to the request with a January 31, 2002, letter to the Services that clarified that FERC intended for consultation on the Carmen-Smith and Blue River projects to be informal since, at that time, there was no pending or proposed Federal action for either of these two projects. The letter requested that the previous BA for the Carmen-Smith and Blue River projects be considered a "biological evaluation" consistent with post-licensing procedures, as developed by the interagency task force. In addition, FERC suggested they would continue to have discussions with the Services and EWEB to collaboratively develop conservation measures for protection of listed species and any appropriate license amendment applications for the Carmen-Smith and Blue River projects.

On August 7, 2002, the Services, EWEB, and FERC met to discuss EWEB's Part 12 Submittal for Trail Bridge Spillway Expansion, and the associated Environmental Assessment and ESA Section 7 consultation. The Part 12 Submittal was a result of a directive by FERC to EWEB based on a reevaluation of historical information to address the capability of the Trail Bridge Spillway to handle the Probable Maximum Flood. Although FERC indicated the Part 12 Submittal is not a license amendment, the action is considered by FERC to be a sufficient Federal action to support formal Section 7(a)(2) consultation. At the above meeting, the Services agreed to assist EWEB in developing conservation measures for inclusion in the draft BA to be submitted to FERC.

The USFWS provided written comments to EWEB on September 5, 2002, specifically addressing the conservation measures proposed in the draft BA to minimize incidental take of bull trout resulting from ongoing operation of the Carmen-Smith Project for the remaining term of its license. On November 1, 2002, EWEB responded to USFWS by electronic mail. In that correspondence, EWEB provided redrafts of the conservation measures based in part on comments provided by USFWS in the September 5, 2002, letter.

On November 18, 2002, the Services, FERC, and EWEB met to discuss the proposed conservation measures, as well as a proposed timeline for relicensing proceedings. The USFWS suggested several changes to the conservation measures that would accompany the Part 12 Submittal, and the Services continued working with EWEB to refine them for inclusion in their draft BA. EWEB submitted the Part 12 Submittal on November 26, 2002, and the draft BA to FERC on December 20, 2002. FERC accepted the BA with no change and forwarded the BA, along with a request for consultation, to the Services on January 3, 2003.

### *2.2 Listed Species Occurring within the Action Area*

The only ESU in the McKenzie subbasin listed under the ESA that is under the jurisdiction of NOAA Fisheries is the UWR chinook salmon. UWR chinook salmon were listed as threatened under the ESA on March 24, 1999 (64 FR 14308).

### *2.3 The Alsea Decision and Status Review Updates for Pacific Salmon and Steelhead*

In a recent decision, *Alsea Valley Alliance v. Evans* (99-6265-HO, D. OR, September 12, 2001) (the Alsea decision), the U.S. District Court in Eugene, Oregon, set aside NOAA Fisheries' 1998 ESA listing of Oregon Coast coho salmon, and ruled that NOAA Fisheries' division of an ESU into protected wild and unprotected hatchery segments was arbitrary and capricious. Specifically, the Court found that NOAA Fisheries' 1998 listing of Oregon Coast coho made improper distinctions beyond the level of an ESU by excluding hatchery populations from listing protection even though they were determined to be part of the same ESU as the listed naturally-spawned populations. Although this ruling affected only one ESU, the interpretive issue raised by the ruling had the potential to affect nearly all of the agency's West Coast salmon and steelhead listing determinations made to date.

During September and October of 2001, NOAA Fisheries received 6 petitions to delist 15 ESUs of Pacific salmon and steelhead. In a *Federal Register* notice published on February 11, 2002, NOAA Fisheries issued its determinations to accept 14 of the petitions. Furthermore, NOAA Fisheries reaffirmed a commitment to review its policy on the division of hatchery salmon populations in ESA status reviews and listing determinations, as well as to issue interim recovery planning targets in support of regional, State, local, and tribal recovery efforts. These reviews have the potential to affect the status of 25 ESUs. The status updates will be completed after the agency revises its policy regarding the way it considers hatchery fish in ESA status reviews and listing determinations. In conjunction with the new policy, NOAA Fisheries will also issue guidelines for using hatchery populations to accelerate recovery and operating hatcheries over the long term to assure that artificial propagation of salmon stocks will not undermine recovery efforts under the ESA. Finally, in support of regional, State, tribal, and local planning efforts, NOAA Fisheries will provide interim estimates of recovery planning targets. Except for the Oregon Coast coho, where the Court ordered delisting, no other salmon or steelhead populations were delisted by the Alsea decision, and, because the U.S. Court of Appeals for the Ninth Circuit granted intervenors-appellants an emergency motion to stay the judgment in the Alsea decision, the Oregon Coast coho ESU has been reinstated as a threatened species under the ESA.

### *2.4 Critical Habitat Designations*

NOAA Fisheries has designated critical habitat for 19 species of Pacific salmon and steelhead. However, on April 30, 2002, the U.S. District Court for the District of Columbia approved a NOAA Fisheries consent decree withdrawing critical habitat designations for 19 salmon and steelhead populations on the West Coast, including that for UWR chinook salmon, which are addressed in this Opinion. Critical habitat designations remain in place for Snake River (SR) sockeye, SR spring/summer chinook salmon, and SR fall chinook salmon. Therefore, this Opinion does not discuss effects of the proposed action on critical habitat for UWR chinook salmon.

# 3. PROPOSED ACTION AND ACTION AREA

The continued operation of the Carmen-Smith Project under the existing license (expiring in 2008), the expansion of the Trail Bridge Emergency Spillway, and the conservation measures proposed by EWEB in the BA constitute the "proposed action" by FERC. A more detailed description of each component of the prosed action is provided below.

## *3.1 Carmen-Smith Project Description and Proposed Continued Operations*

The design and operation of the Carmen-Smith Project is described in detail in the BA (FERC 2003) and that description is hereby incorporated by reference and briefly summarized below.

Completed in 1963, the Carmen-Smith Hydroelectric Project lies downstream from Clear Lake on the McKenzie River (Figure 3-1). The Carmen-Smith Project (Figure 3-1) consists of three separate developments that are operated as an integrated unit by EWEB: 1) Carmen Dam and Reservoir on the upper McKenzie River; 2) Smith River Dam and Reservoir on the Smith River, a tributary of the upper McKenzie River; and 3) Trail Bridge Dam and Reservoir, also on the upper McKenzie River but several miles downstream of Carmen Dam. Carmen Dam diverts most of the McKenzie River into a tunnel leading to Smith River Reservoir, where Smith River and McKenzie River water are stored and routed into a tunnel to the Carmen powerhouse just upstream of Trail Bridge Reservoir. Finally, water stored in Trail Bridge Reservoir is used to operate the Trail Bridge powerhouse at the base of the Trail Bridge Dam.

The Carmen-Smith Project is operated as a load-following facility, utilizing the water stored in each of the three project reservoirs in different modes. The Carmen powerhouse operates in a peaking mode, while the Trail Bridge powerhouse operates as a re-regulating facility. The overall operational mode of the project, however, is such that, on an average daily basis, inflow to the project via the McKenzie and Smith rivers matches outflow at Trail Bridge powerhouse tailrace. Thus, the impounded water is not stored by the project on a long-term basis.

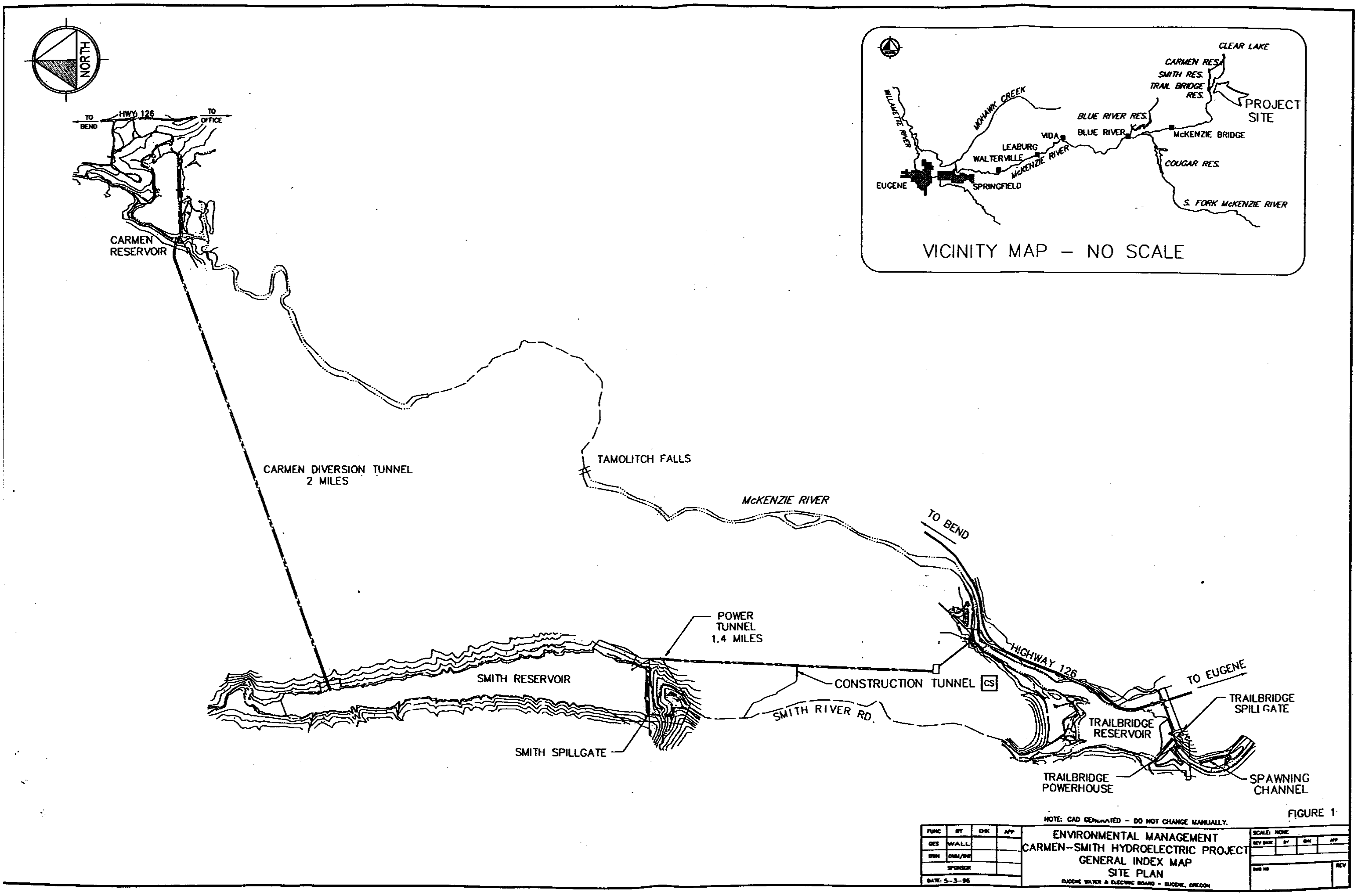


Figure 3-1. The Carmen-Smith Project; McKenzie River, Oregon.

### 3.1.1 Carmen Diversion Dam and Reservoir

The Carmen Diversion Dam is the uppermost dam in the project, and it creates the Carmen Reservoir. The reservoir diverts most of the water from the McKenzie River and Icecap Spring, about 2 miles to the west, through the Carmen Division Tunnel to Smith River Reservoir. Riverflow in the McKenzie River naturally disappears below Carmen Dam then reappears a short distance downstream at Tamolitch Falls. The diversion dam has a height of 25 feet and a crest length of 2,180 feet. The reservoir covers an area of about 30 acres at an elevation of 2,625 feet when it is full. Silt has not significantly accumulated in the reservoir. The spillway is toward the west end of the dam, and the intake structure for the Carmen Diversion Tunnel is to the west side of the spillway. The spillway is a 63-foot-long free flowing weir with two sluice gates that are controlled by removing concrete stoplogs. The Carmen Diversion Tunnel carries water diverted from the Carmen Reservoir to the Smith River Reservoir. The concrete-lined tunnel is circular, has a 9.5 foot diameter, and is 11,381 feet long. Between Carmen and Smith River reservoirs, there is an elevation drop of about 25 feet at normal reservoir operating levels. The tunnel enters Smith River Reservoir about 40 feet below the average water level and about three-fourths of the way up the reservoir from Smith River Dam. A trash rack is mounted at the entrance to the diversion tunnel. The rack can be lifted to remove debris or to allow debris to float through the tunnel. The entrance does not have a fish screen. As a result, fish can pass through the diversion tunnel to Smith River Reservoir.

### *3.1.2 Smith River Dam and Reservoir and Carmen Powerhouse*

The Smith River development consists of the Smith River Dam, reservoir, power tunnel and penstock, powerhouse, and transmission line. Smith River Reservoir is created by Smith River Dam, which collects water from Smith River and the Carmen Diversion Tunnel. The Smith River Dam is located just above the mouth of Bunchgrass Creek on the Smith River, which is a direct tributary of the McKenzie River. An intake structure in Smith River Reservoir channels the diverted McKenzie River and the Smith River waters through a power/penstock to the Carmen powerhouse and then to the Trail Bridge Reservoir.

Smith River Dam is 218.5 feet tall and 1,100 feet long. The dam creates Smith River Reservoir at an elevation of 2,605 feet. When the reservoir is full, it covers an area of about 170 acres and stores 9,900 acre feet. A floating boom extends from the west shore to the middle of the dam just above the spillway. Smith River Dam has a spillgate on the west end. If the reservoir level reaches an elevation of 2,605.25 feet (alarm at 2605.00), the spillgate rises automatically to release water.

The intake structure in Smith River Reservoir is located upstream from the dam. The structure is a concrete platform built on a concrete cylindrical section extending to the bottom of the reservoir. Water entering the intake structure immediately flows through the power tunnel. The Smith River Reservoir power tunnel runs about 7,275 feet from the intake structure to the penstock for the Carmen powerhouse. The tunnel is an inverted-horseshoe shape, is concrete-lined with steel rib supports, and has a diameter of 13 feet, 10 inches. A surge chamber at the end of the power tunnel rises 260 feet, of which 50 feet are above ground. The subterranean section of the surge chamber is 31 feet in diameter, and the area above ground is 40 feet in diameter.

The Carmen powerhouse penstock runs from the surge chamber a distance of 1,284 feet to Carmen powerhouse. The penstock is steel-lined and 12 feet in diameter. The Carmen powerhouse is the principal generation facility at the project. The powerhouse is a large concrete structure that projects into the McKenzie River. The Carmen powerhouse has two 54,000 kilowatt generators. The powerhouse substation is located on the roof of the powerhouse. There is a 1-mile segment of 13.8 kV transmission line that connects the Carmen substation with the Trail Bridge powerhouse.

### *3.1.3 Trail Bridge Dam, Reservoir, and Powerhouse*

Trail Bridge Reservoir is created by Trail Bridge Dam, spanning the main McKenzie River below the confluence with Smith River. The impoundment created by the dam (Trail Bridge Reservoir) leaves a short distance of about 2 miles between the upstream end of the reservoir and the impassable Tamolitch Falls. Water from the Trail Bridge Reservoir is discharged through the Trail Bridge powerhouse into the McKenzie River. Trail Bridge Dam is 98 feet tall and 620 feet long. The dam creates Trail Bridge Reservoir at an elevation of 2,092 feet. When the reservoir is full, it covers an area of about 120 acres and stores 2,100 acre feet. Several creeks flow into Trail Bridge Reservoir.

Trail Bridge Dam has a spillgate on the east end. If the reservoir level reaches an elevation of 2,090.25 feet (alarm at 2,090.00 feet), the spillgate rises automatically to release water.
Trail Bridge powerhouse (10,000 kw nameplate rating) operates continuously to match water outflow with water inflow. The top of the penstock is approximately 60 feet beneath the surface of Trail Bridge Reservoir, with the penstock opening approximately 200 feet out in front of the spillgate. Water flows through the penstock, turns the turbines, and is then discharged into the tailrace. A 20-mile, 115 kv transmission line connects the project to the Cougar switchyard. The transmission corridor is 70-80 feet wide, and except for a section along Deer Creek, the transmission corridor runs down the McKenzie River valley.

### *3.1.4 Carmen-Smith Project Operation*

The Carmen-Smith Project is operated as a load-following facility, utilizing the water stored in each of the three project reservoirs in different modes. The Carmen powerhouse operates in a peaking mode, while the Trail Bridge powerhouse operates as a re-regulating facility. The overall operational mode of the project, however, is such that, on an average daily basis, inflow to the project via the McKenzie and Smith rivers matches outflow at Trail Bridge powerhouse tailrace. Thus, the impounded water is not stored by the project on a long-term basis.

The Carmen Reservoir is operated at different levels throughout the year. During winter, EWEB lifts the diversion gates out of the water allowing lake elevation to change with inflow. EWEB maintains a log boom float across the reservoir above the diversion tunnel and spillway to prevent boats and floating debris from entering the diversion tunnel and the spillway. Large debris that collects on the boom is pulled off to the side of the reservoir and removed from the water. The boom is also detachable so that debris can be allowed to pass over the spillway. The Smith River Reservoir and Carmen powerhouse operate as peaking facilities.

Water levels in Smith River Reservoir fluctuate on a daily and seasonal basis. During summer months, Smith Reservoir is maintained near full pool, with daily water level fluctuations of between 2 and 3 feet. During winter months, the water elevation is lowered 10 feet below full pool, and continues to modulate the level by 2-3 feet every day. The 10-foot winter drawdown is designed to capture high runoff from the Smith River. As a result, spills at Smith River Dam are rare. Minimum releases are not made from Smith River Reservoir, although inflow from Bunchgrass Creek, directly downstream of Smith Dam, maintains perennial flow in lower Smith River.

The Trail Bridge Reservoir is operated as a re-regulating facility. This operation ensures that the effect of power peaking at the Carmen powerhouse does not result in river flow fluctuations in the McKenzie River downstream of Trail Bridge Reservoir. The FERC license limits the rate of change of the McKenzie River due to project operation not to exceed two inches per hour. Daily and weekly limits on artificial variation to river stage are also in place, varying from 2 inches from Labor Day to October 20, to 7 inches daily and 9 inches weekly from October 20 through April 19. From April 20 to Labor Day the daily and weekly limit for artificial variation is 4 inches.

The license also restricts EWEB to a 7-foot fluctuation on a daily basis at Trail Bridge Reservoir between Memorial Day and Labor Day of each year. There is no license restriction on reservoir variation during the rest of the year. The maximum summer water elevation is 2090 feet, but the typical daily upper level elevation for the reservoir during the summer is closer to 2088 feet. Daily upper reservoir elevation may vary slightly ($\pm$ 1-2 ft) during winter operations. EWEB has fluctuated water levels up to 12 feet during the non-summer period. Reservoir elevations are always kept above 2076 feet to assure turbine emergency cooling water intakes are always wetted. As discussed above, the re-regulating nature (i.e., downstream flow levels and rate of reservoir level change) of the Trail Bridge Reservoir is controlled by ramping rate criteria in the FERC license for the McKenzie River downstream of Trail Bridge powerhouse.

On a daily cycle, Trail Bridge Reservoir is lowest in early morning, typically between 6 a.m. and 8 a.m., filling throughout the day from increased discharge from Smith Reservoir via the Carmen powerhouse. Peak reservoir elevation is typically reached between 8 p.m. and 10 p.m. The rate of discharge through the Carmen powerhouse is generally greatest during the high electricity use morning and evening periods, therefore the rate of filling in Trail Bridge Reservoir is typically greatest during the first and last parts of the filling cycle. EWEB maintains a log boom float across Trail Bridge Reservoir to prevent boats and floating debris from entering the spillway area. Large debris that collects on the boom is pulled off to the side of the reservoir and removed from the water. Large and moderate-size woody debris collected in this fashion is provided to the Willamette National Forest (WNF), which uses it for timber salvage and fish habitat enhancement projects on the forest. The boom is also detachable so that debris can be allowed to pass over the spillway.

#### *3.1.5 Natural Resource Protection Required by FERC License*

The Carmen-Smith Project is licensed by FERC, and EWEB must follow conditions of the license related to natural resource protection. The conditions are contained in the original license, issued on January 8, 1959, and in subsequent orders issued by FERC. This license will expire in 2008. A brief summary of the license articles governing operations of the Carmen-Smith Project was provided by EWEB to the Services on March 27, 2001, as an amendment to the original BA (FERC 2001) and these are hereby incorporated by reference.

Several license articles are pertinent to fish and aquatic habitat within and below the Carmen-Smith Project. The resolution of the State Water Resources Board of Oregon cited and accepted in Article 34 describes the Carmen-Smith Project and establishes the water right for the Carmen-Smith Project. The agreement with the Oregon State Game and Fish Commission (now Oregon Department of Fish and Wildlife), cited and accepted in Article 35, includes spawning channel construction based on provided criteria and descriptions, and limitations on artificial variation of the water level in Trail Bridge Reservoir and flow in the McKenzie River downstream from the project. Article 36 states the licensee shall construct, operate and maintain protective devices and comply with reasonable modification in project structure and operation in the interest of fish and wildlife resources as may be prescribed hereafter by the FERC upon the recommendation of the Secretary of the Interior, and the Fish and Game Commission (now Oregon Fish & Wildlife Commission).

Table 3-1. Maximum allowable artificial variation of the Trail Bridge Reservoir water level and the McKenzie River downstream from Trail Bridge Dam.

| Period | McKenzie River Max. Daily Variation | McKenzie River Max. Weekly Variation | Trail Bridge Reservoir. Max. Daily or Weekly Variation |
|---|---|---|---|
| April 20 through Labor Day | 4 inches | 4 inches | 7 feet |
| Labor Day through October 20 | 2 inches | 2 inches | No restriction |
| October 20 through April 19 | 7 inches | 9 inches | No restriction |

Rate of change of the McKenzie River below Trail Bridge Dam will not exceed two inches per hour. Flow fluctuations and reservoir level changes are to be measured at recording gages installed and maintained by EWEB in the following locations: 1) in the McKenzie River at a point not more than 1/4 mile below the Trail Bridge Dam and 2) in the Trail Bridge Dam forebay at a convenient location.

No minimum reservoir releases to the river channel for fish and wildlife purposes are specified below the Carmen Diversion Dam and the Smith River Dam. There are no upstream or downstream fish passage facilities at the Carmen-Smith Project, nor are there any screens to prevent fish from being entrained into any of the diversion tunnels, spillways or turbines.

### *3.1.6 Carmen-Smith Project Chinook Salmon Spawning Channel*

As part of the Carmen-Smith Project, EWEB operates a spawning channel approximately 800 feet downstream from the Trail Bridge Dam. The channel has a gravel bed with sills and holding pond area at its upper and lower ends, respectively. The channel was constructed to the specifications of Oregon Department of Fish and Wildlife (ODFW) and based on comments by USFWS. A velocity barrier in the McKenzie River downstream of Trail Bridge Dam prevents fish from swimming upstream and directs them into the bottom of the spawning channel. EWEB annually maintains the channel by aerating silt out of the gravel. Shade trees have been planted on the sides of the channel, and large wood is anchored in the channel to provide cover and habitat for spawning fish.

## *3.2 Trail Bridge Dam Emergency Spillway Modification*

In a Part 12 inspection for the Carmen-Smith Hydroelectric Project, an independent consultant identified a potential for the Trail Bridge Dam to overtop during the Probable Maximum Flood. At the direction of FERC, EWEB began evaluating alternatives to address the potential need for additional capacity to pass the Probable Maximum Flood.

In August 2001, EWEB submitted to FERC a “Supplement to 1998 FERC Part 12 Report, Flood

Routing and Evaluation of Emergency Spillway Alternatives at Trail Bridge Dam, Carmen-Smith Hydroelectric Project, FERC Project No. 2242." In the Spillway Alternatives Supplement, EWEB's consultant recommended that EWEB lower and modify the Saddle Dike to provide the necessary additional spillway capacity at the Trail Bridge Dam. In October 2001, FERC accepted EWEB's proposal to lower the Saddle Dike.

For the proposed project, EWEB will lower about 300 linear feet of the crest of the Saddle Dike by 11 feet with vehicle access ramps at each end. This lowered elevation will be 0.7 feet higher than the maximum normal Trail Bridge Reservoir elevation that occurs only during the low flow (high head) summer months.

Each end of the lowered Saddle Dike will be ramped up the top of the dike at a grade of 15% to permit continued use of the dike for vehicle access to the Trail Bridge Dam. The project will include the placement of a barrier over the lowered crest of the Saddle Dike, across the ramp at each end of the lowered portion of the dike, and across the downstream slope and along the toe of the Saddle Dike. The barrier will protect the lowered portion of the dike from erosion in the event of the occurrence of the Probable Maximum Flood, and will also provide protection from wear by vehicular traffic.

During the original construction of the project, an impervious soil blanket was constructed against the right bank of the reservoir and connected to the core of the main dam. The blanket extends upstream of the dam about 400 feet. Its purpose was to reduce seepage around the right abutment of the dam. The top elevation of the blanket is approximately 4-5 feet below the crest elevation of the dam. As part of the emergency spillway project it will be necessary to raise the top of the blanket to the crest of the dam over a length of several hundred feet. This will be accomplished using suitably impervious soils from the required excavation of the Saddle Dike emergency spillway.

The construction can be accomplished without significant disturbance to the existing trees along the reservoir shoreline. The area of planned construction along the top of the blanket is relatively free of trees. The project will involve no dredging, filling, or other in-water work. The erosion barrier placed over the Saddle Dike will not extend below the minimum normal water line, and no in-water work will be required for installation of the barrier. EWEB will implement best management practices to prevent any discharge to surface water and to ensure that the project will not otherwise impact water quality.

### *3.3 EWEB's Proposed Conservation Measures to Avoid and Minimize Operation-Related Impacts to Aquatic Species*

EWEB has proposed conservation measures to minimize incidental take of listed species that may occur as a result of the continued operation of the Carmen-Smith Project through the expiration of the license in 2008. Many of EWEB's proposed Conservation Measures involve studies that will result in useful information for future consultation on relicensing of the Carmen-Smith Project, while other Conservation Measures will result in immediate modifications of project features or operations, and other actions that reduce adverse effects on chinook salmon.

EWEB's proposed Conservation Measures, which are part of FERC's proposed action, contain a number of studies and actions developed jointly by EWEB, FERC, NOAA Fisheries, and USFWS during consultation meetings in 2000, 2001, and 2002. Because the Conservation Measures (and the studies they describe) are considered part of the proposed action, the implementation of these measures will be analyzed in the "effects of the action" section of this consultation. However, potential take of chinook salmon from the capture, handling, and monitoring of chinook salmon in association with several of the proposed conservation measures will not be considered "incidental" and EWEB must apply to NOAA Fisheries for a Section 10(a)1(A) permit. The FERC BA (2003) and this BO will facilitate the issuance of the required 10(a)1(A) permit.

EWEB's proposed Conservation Measures are provided below. While some measures are specific to bull trout, they are included since they are components of the proposed action described in the BA (FERC 2003).

### *3.3.1 EWEB's Proposed Conservation Measure for Fish Passage*

EWEB will develop and implement a study plan of fish passage (upstream and downstream) at Trail Bridge Dam and Smith Dam with regard to chinook salmon and bull trout that addresses at least: 1) the amount and current quality of spawning, rearing and foraging habitat for these two species above each dam; 2) upstream fish passage alternatives, including type of fish passage facility, potential benefits and detriments to each listed species, cost, and time required for construction; and 3) downstream fish passage alternatives, including type of fish passage facility, potential benefits and detriments to each listed species, cost, and time required for construction. The downstream fish passage component of the study will be linked inherently to the entrainment study in Conservation Measure 3.3.7. The Fish Passage Study will identify short-term, interim upstream passage measures that could potentially be in place in 2006. Interim downstream passage measures may be necessarily dependent upon interim actions resulting from the entrainment studies in Conservation Measure 3.3.7. The Fish Passage Study should also identify long-term upstream and downstream passage measures to be addressed during relicensing in 2008.

Based on a draft initial relicensing schedule developed by EWEB, the study plan shall be developed in consultation with, and approved by, the Services no later than March 15, 2004. Implementation of the Fish Passage Study will begin within 30 days of approval, with the results of the study submitted to the Services for review by May 15, 2006. Within 60 days after submission to the Services of the results of the studies, EWEB will submit to the Services for review and approval a plan for implementing interim upstream passage actions to minimize passage related incidental take of bull trout and/or chinook salmon from the operation of the Carmen-Smith Project. To the extent that such interim action(s) do not alter the basic design, location, scope, duration, or timing of the Carmen-Smith Project, and involve only minor changes, and do not result in either decreased efficiency, material increase in cost, or impairment of the general scheme of development, then EWEB will implement the interim action(s) to provide fish passage by the 2006 migration period for bull trout and chinook salmon. To the extent that such interim action(s) alter the basic design, location, scope, duration, or timing of the Carmen-Smith Project, or do not involve only minor changes, or result in either decreased efficiency, material increase in cost, or impairment of the general scheme of development, then within 120 days after the Services approve such interim action(s) EWEB will file with FERC an application to amend the license to authorize implementation of the interim action(s).

Assuming results of the entrainment study (3.3.7) and component (1) of the passage study (assessment of available spawning and rearing habitat) indicate a net benefit to transporting unmarked chinook salmon above Trail Bridge Dam, unmarked chinook salmon may be transported above the project as a result of this interim action. Upon request by EWEB based on changes in the relicensing schedule, the Services may approve an extension to the date for development of the study plan and submission of the results of the study. If such an extension is granted, it would not require amendment of the Opinion nor would it affect the incidental take statement, because it does not involve a substantive change to the proposed project. However, while NOAA Fisheries considers scheduling changes to be within the scope of the analysis in this Opinion, its analysis assumes that EWEB will meet FERC's relicensing schedule. As stated in section 3.5, this Opinion considers the effects of the action for up to 5 years of annual licenses.

In addition, EWEB will begin collecting information on the number of adult and sub-adult bull trout migrating upstream to the velocity barrier/spawning channel area below Trail Bridge Dam during the 2003 fall spawning season. EWEB will design, install, and operate a video counting system or comparable system in or near the entrance of the Carmen Smith spawning channel during the period August through October to count the number of bull trout entering the channel. Monitoring will continue each season at least through the 2005 spawning season, providing three years of data on the timing of bull trout migration and abundance. This information will be considered in the Fish Passage Study plan.

### *3.3.2 EWEB's Proposed Conservation Measure for Water Temperature*

EWEB will develop and implement a water temperature study plan for Carmen, Smith, and Trail Bridge dams and reservoirs to determine the effects of these dams and reservoirs on the natural temperature regime of the McKenzie River. Based on a draft initial relicensing schedule developed by EWEB, the study plan will be developed in consultation with, and approved by, the Services by no later than March 15, 2004, with the results of the study submitted to the Services for review by May 15, 2006. Upon request by EWEB based on changes in the relicensing schedule, the Services may approve an extension to the date for development of the study plan and submission of the results of the study. If such an extension is granted, it would not require amendment of the Opinion nor would it affect the Incidental take statement, because information developed from the implementation of this conservation measure is not expected to result in changes to project operation under the proposed action, but rather for future analysis during impending relicensing.

### *3.3.3 EWEB's Proposed Conservation Measure for Nutrients*

In order to facilitate and enhance nutrient availability for bull trout above Trail Bridge Dam, EWEB will reimburse ODFW for its actual costs in an amount not to exceed $1,000 annually for ODFW's transfer of excess hatchery chinook salmon above Trail Bridge Dam beginning in 2003 and continuing as long as the Opinion and the accompanying Incidental take statement are in effect. Although outplanting excess live hatchery chinook salmon is preferable due to the added benefit of natural distribution, after receiving approval from the Services, carcass placement might be an allowable substitute. Funding of this measure will not be necessary if 1) excess hatchery chinook salmon (either live or as carcasses) are not available, 2) NOAA determines outplanting of live hatchery chinook salmon is no longer consistent with ODFW's Conservation Plans developed under their Native Fish Conservation Policy or NOAA's Opinion for Willamette hatchery programs, 3) for other reasons ODFW terminates its transfer of excess hatchery chinook salmon above Trail Bridge Dam, or 4) passage of unmarked chinook salmon is provided over Trail Bridge Dam.

### *3.3.4 EWEB's Proposed Conservation Measure for Hydrogeomorphology*

EWEB will develop and implement a hydrogeomorphic study to determine the effects of the Carmen-Smith Project on sediment dynamics and large wood function within the upper McKenzie River within and below the Carmen-Smith Project. Based on a draft initial relicensing schedule developed by EWEB, the study plan will be developed in consultation with, and approved by, the Services by no later than March 15, 2004, with the results of the study submitted to the Services for review by May 15, 2006. Upon request by EWEB based on changes in the relicensing schedule, the Services may approve an extension to the date for development of the study plan and submission of the results of the study. If such an extension is granted, it would not require amendment of the Opinion nor would it affect the Incidental take statement because information developed from the implementation of this conservation measure is not expected to result in changes to project operation under the proposed action, but rather for future analysis during impending relicensing.

### *3.3.5 EWEB's Proposed Conservation Measure for Fish Stranding*

EWEB will design and implement a study to assess the potential stranding of bull trout and chinook salmon within and below the Carmen-Smith Project associated with the typical daily fluctuations that exist under normal operational regimes of the project. Based on a draft initial relicensing schedule developed by EWEB, the study plan will be developed in consultation with, and approved by, the Services by no later than March 15, 2004, with the results of the study submitted to the Services for review by May 15, 2006. Upon request by EWEB based on changes in the relicensing schedule, the Services may approve an extension to the date for development of the study plan and submission of the results of the study. If such an extension is granted, it would not require amendment of the Opinion nor would it affect the Incidental take statement, because information developed from the implementation of this conservation measure is not expected to result in changes to project operation under the proposed action, but rather for future analysis during impending relicensing.

### *3.3.6 EWEB's Proposed Conservation Measure for Fish Population Abundance*

EWEB will design and implement a study to assess the abundance of bull trout and other native and non-native fish within the Carmen-Smith Project. In the development of the study plan, the following techniques will be considered: 1) a creel survey to document incidental harvest of bull trout, and total harvest of eastern brook trout; 2) a quantitative estimate of all char (bull trout and eastern brook trout) within the reservoir, using non-lethal sampling approaches; 3) sampling by the use of Vaki fish counters on Sweetwater Creek, Smith River and the upper McKenzie River as an adjunct to rigorous redd surveys (foot and snorkel) in all three tributaries; and 4) fry trapping in Sweetwater Creek, and Smith and McKenzie rivers to estimate natural recruitment. Based on a draft initial relicensing schedule developed by EWEB, the study plan will be developed in consultation with, and approved by, the Services no later than March 15, 2004. Implementation of the fish population abundance study will begin within 30 days of approval, with the results of the study submitted to the Services for review by May 15, 2006. Upon request by EWEB based on changes in the relicensing schedule, the Services may approve an extension to the date for development of the study plan and submission of the results of the study. If such an extension is granted, it would not require amendment of the Opinion nor would it affect the Incidental take statement, because information developed from the implementation of this conservation measure is not expected to result in changes to project operation under the proposed action, but rather for future analysis during impending relicensing.

### *3.3.7 EWEB's Proposed Conservation Measure for Fish Entrainment*

EWEB will design and implement a study to assess the rate of entrainment, and associated injury or mortality, to bull trout and chinook salmon entering the turbine intake or passing through the spillway gate at Trail Bridge Dam. In the development of the study plan, the following techniques will be considered: 1) field sampling, 2) a review of entrainment and mortality studies in the literature, 3) a review of previous installations of screening or other deterrent devices at similar hydro facilities, and 4) and evaluation of the effectiveness of the installation of similar devices on Trail Bridge Dam. Based on a draft initial relicensing schedule developed by EWEB, the study plan will be developed in consultation with, and approved by, the Services no later than March 15, 2004. Implementation of the fish entrainment study will begin within 30 days of approval, with the results of the study submitted to the Services for review by May 15, 2006. Upon request by EWEB based on changes in the relicensing schedule, the Services may approve an extension to the date for development of the study plan and submission of the results of the study. If such an extension is granted, it would not require amendment of the Opinion nor would it affect the incidental take statement.

If entrainment studies demonstrate adverse effects on bull trout and chinook salmon, EWEB will, within 60 days after submission to the Services of the results of the studies, submit to the Services for review and approval a plan for implementing interim entrainment reduction actions to minimize the impact of entrainment of bull trout and/or chinook salmon from the operation of the Carmen-Smith Project analyzed in the studies. To the extent that such interim entrainment reduction action(s) do not alter the basic design, location, scope, duration, or timing of the Carmen-Smith Project, and involve only minor changes, and do not result in either decreased efficiency, material increase in cost, or impairment of the general scheme of development, then EWEB will implement these interim entrainment reduction action(s) by no later than the following construction season (2006). To the extent that such interim entrainment reduction action(s) alter the basic design, location, scope, duration, or timing of the Carmen-Smith Project, or do not involve only minor changes, or result in either decreased efficiency, material increase in cost, or impairment of the general scheme of development, then within 120 days after the Services approve such interim entrainment reduction action(s) EWEB will file with FERC an application to amend the license to authorize implementation of the interim entrainment reduction action(s). The plan for implementing interim actions will cover the period as long as the Opinion and accompanying Incidental take statement are in effect.

### *3.3.8 EWEB's Proposed Conservation Measure for Bull Trout Habitat Enhancement Study*

EWEB will design and implement a study to evaluate opportunities to enhance habitat conditions for bull trout above Trail Bridge Reservoir. The proposed study would focus on the potential to improve habitat conditions in Sweetwater Creek, Smith River upstream of Trail Bridge Reservoir, and the mainstem McKenzie River above and below Trail Bridge Dam. Habitat conditions studied at a minimum include spawning gravel enhancement, large woody debris, and extending or adapting the Sweetwater Creek culvert outfall to Trail Bridge Reservoir. Based on a draft initial relicensing schedule developed by EWEB, the study plan will be developed in consultation with, and approved by, the Services by no later than March 15, 2004, with the results of the study submitted to the Services for review by May 15, 2006. Upon request by EWEB based on changes in the relicensing schedule, the Services may approve an extension to the date for development of the study plan and submission of the results of the study. If an extension is granted, it would not require an amendment of the Opinion nor would it affect the Incidental take statement. Although information developed from the implementation of this conservation measure may result in a change in project operation and/or the completion of habitat restoration actions, under the proposed action, the Services expect the resulting information to be utilized primarily for determining long-term habitat restoration actions under future relicensing proceedings.

### *3.3.9 Conservation Measure for Implementation of Habitat Enhancement: Projects Above Trail Bridge Dam*

In order to improve spawning and rearing habitat for bull trout, and listed chinook salmon, if they are moved above Trail Bridge Dam in the future, EWEB will provide funding in an amount not to exceed a total of $50,000 to the U.S. Forest Service (USFS) McKenzie River Ranger District to pay actual project costs of placing approximately 60 pieces of large wood in a 1-mile reach of the McKenzie River from the head of Trail Bridge Reservoir upstream to Kink Creek. The USFS plans to implement this project in 2003 or 2004 depending upon when the USFS's National Environmental Policy Act (NEPA) process (currently under way) is completed. Consultation under the ESA has been completed. Upon request by EWEB based on changes in the USFS McKenzie Ranger District schedule, NOAA Fisheries may approve an extension to the date for implementing this conservation measure. If such an extension is granted, it would not require amendment of the BO nor would it affect the Incidental take statement.

In addition, to improve cover and rearing habitat for bull trout fry and small juveniles migrating out of Sweetwater Creek into Trail Bridge Reservoir, EWEB will provide funding in an amount not to exceed a total of $5,000 to the USFS McKenzie River Ranger District to pay actual project costs to add additional "brush bundles" in the reservoir to those already present near the culvert at the mouth of Sweetwater Creek. The USFS plans to implement the project in 2003 or 2004 depending upon when the USFS's NEPA process is completed. The USFS has completed Section 7(a)(2) consultation under the ESA. Upon request by EWEB based on changes in the USFS McKenzie Ranger District schedule, NOAA Fisheries may approve an extension to the date for implementing this conservation measure. If such an extension is granted, it would not require amendment of the Opinion nor would it affect the Incidental take statement.

### *3.3.10 Conservation Measure for Implementation of Habitat Enhancement: Projects Below Trail Bridge Dam*

In order to reclaim and to improve side channel habitat (spawning, rearing, foraging,and over-wintering habitat) for spring chinook salmon and bull trout in the McKenzie River below Trail Bridge Dam, EWEB will provide funding in an amount not to exceed a total of $50,000 to the USFS McKenzie River Ranger District to pay actual project costs for enhancement of one or two top priority side-channel sites within an approximately 23-mile section of the mainstem river from Trail Bridge Dam downstream to Dearborn Island. Based on recent surveys, the number and quality of side channels in this area have been reduced from historic levels. The USFS plans to implement this project in 2003 or 2004 depending upon when the USFS's NEPA process is completed. Consultation under the ESA has been completed. Upon request by EWEB based on changes in the USFS McKenzie Ranger District schedule, NOAA Fisheries may approve an extension to the date for implementing this conservation measure. If such an extension is granted, it would not require amendment of the Opinion nor would it affect the Incidental take statement.

In addition, to replenish and to enhance the spawning channel area used by spring chinook salmon downstream of Trail Bridge Dam, EWEB will add spawning gravel to the spawning channel during the in-water work period from July 1 through August 15, in cooperation with the USFS McKenzie River Ranger District. Implementation will occur in 2003 or 2004 depending upon when the USFS's NEPA process is completed and necessary fill and removal authorization, if any, is obtained. The USFS has completed Section 7(a)(2) consultation under the ESA. Upon request by EWEB based on changes in the USFS McKenzie Ranger District schedule, NOAA Fisheries may approve an extension to the date for implementing this conservation measure. If such an extension is granted, it would not require amendment of the Opinion nor would it affect the Incidental take statement.

### *3.4 Action Area*

NOAA Fisheries defines the action area as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). A dam and reservoir directly influence three basic areas: the channel downstream of the structure, the portion of channel and valley that is impounded, and locations upstream that are or could otherwise be accessed and used by anadromous or resident fish. The continued operation of the Carmen-Smith Project and implementation of the proposed conservation measures will affect reaches of both the Smith and McKenzie rivers.

Construction associated with the Trail Bridge Dam Emergency Spillway Expansion would affect a localized area surrounding Trail Bridge Dam. However, continued operation of the Carmen-Smith Project affects a much larger area.

Thus, the action area for this consultation includes the reach of the Smith River from the upstream end of Smith River Reservoir downstream to the confluence with the McKenzie River (within Trail Bridge Reservoir), and the McKenzie River from the upstream end of Carmen Reservoir downstream to the confluence of the McKenzie and Willamette rivers. However, habitat processes that provide biological requirements of chinook salmon, such as sediment and large wood transport, are interrupted by the presence and operation of the Carmen-Smith Project. Thus, while the effect of this interruption diminishes downstream, the effect could likely be detected as far downstream as the confluence of the McKenzie and Willamette rivers.

### *3.5 Term of this Biological Opinion*

This Opinion addresses the effects of operation of the Carmen-Smith Project through the end of its existing license, which expires in 2008. Should there be a delay in issuing a new license, or a new license becoming final, NOAA Fisheries expects that FERC would issue an annual operating license(s) for the Carmen-Smith Project, under the terms of the previous license, until a new license becomes final. Thus, the end date associated with the proposed action of continued operation of the Carmen-Smith Project under the terms of the existing license is uncertain. To account for this uncertainty, this Opinion will remain in effect until ESA consultation is completed on a new Federal action on the Carmen-Smith Project (e.g., a new project license), but no later than 2013. Thus, the effects of the action are analyzed over a maximum 10-year time frame.

# 4. BIOLOGICAL INFORMATION

This section describes the life history, status, and factors for decline of UWR chinook salmon.

## *4.1 Life History*

UWR chinook salmon have a life history pattern that includes traits from both ocean- and stream-type life histories. The majority of juveniles emigrate as young-of-the-year in late winter/early spring and as age-1 fish in the fall. A relatively small number presently emigrate through the second spring. The ocean distribution of fish from this ESU, most of which are caught off the coasts of British Columbia and Alaska, is consistent with an ocean-type life history. Freshwater entry begins in February, the earliest return timing of chinook salmon stocks in the Columbia Basin (USACE 2000; FERC 2001). Life history is summarized below in terms of spawning, rearing, outmigration, ocean stage, and age at maturity.

### *4.1.1 Spawning*

Adult UWR chinook salmon begin entering the Willamette River in February. The run peaks in April and entry continues, at lower levels, through June. Adults begin entering spawning tributaries like the McKenzie River as early as mid- to late April when water temperatures begin to reach 11.1°C to 12.2°C. Spawning occurs from August to early November, peaking around the third week in September through the first week in October.

After spawning, UWR chinook salmon eggs remain buried in the gravel for one to four months, depending on stream temperatures. Chinook salmon eggs require 882 to 991 temperature units (TU) on average before hatching (1 TU = 1˚C above freezing for 24 h). After hatching, the alevins, or yolk-sac fry, remain in the gravel for two to three weeks (depending on stream temperatures).

### *4.1.2 Rearing and Outmigration*

Studies suggest that the majority of juvenile UWR chinook salmon historically reared to age 1 or older in the upper Willamette River basin before emigrating to the estuary. In the 1940s, spring chinook salmon juveniles were found to outmigrate at different ages and at different times of the year near Lake Oswego: 1) age 0+ fry (length 40-90 mm) in late winter/early spring, 2) age 1+ fingerlings (length 100-130 mm) in late fall/early winter, and 3) a second spring peak of age 2 smolts (length 100-140 mm) (Mattson 1962). Less than half of a given age class emigrated as 0+, less than half as age 1+, and less than a third as age 2. This study was conducted after the Willamette River had already been subjected to water pollution for several decades; thus, the author suggested that, historically, juvenile UWR chinook salmon may have continued migrating throughout the summer (Mattson 1962).

Currently, naturally-produced juvenile UWR chinook salmon have two peak outmigration periods at Willamette Falls (5 miles upstream of Lake Oswego): 1) age 0+ fry in late winter/early spring; and 2) age 1+ fingerlings in late fall/early winter, a pattern similar to that observed by Mattson in the 1940s. The 0+ group may rear in the lower Willamette or lower Columbia rivers. The age at which each group enters the ocean is not known, nor is it known if survival is higher among one group or the other. Mattson (1963) found that only 8 of 59 (13.5%) returning adults in the McKenzie in 1947 had entered the ocean as subyearlings, suggesting higher survival of juveniles that entered the ocean when they were older and larger. Juvenile UWR chinook salmon appear to emigrate to mainstem areas of major subbasins, including sections of the Willamette River, in late winter and spring and to rear there until smoltification.

ODFW has collected some seine data in the upper mainstem Willamette River each year since 1991, mostly during the summer. Juveniles at various stages of development from fry to smolts have been collected from Peoria (river mile [RM] 143) upstream to the mouth of the McKenzie River (RM 176). Of particular interest was the capture of numerous newly emergent chinook salmon fry in April 1995 in the reach from Harrisburg (RM 162) to Marshall Island (RM 170). ODFW concluded that these were naturally-produced fish because, at that time, hatcheries did not release fish of this size. It is likely that the fish originated from the lower McKenzie River, because mainstem habitat below Peoria is less diverse with fewer islands, fewer backwater areas, and a more modified channel, characteristics that reduce its value as rearing habitat for spring chinook salmon (USACE 2000).

Two of the three outmigrant groups described by Mattson (1962) are still. There may have been greater changes in outmigration timing in the tributaries; based on sampling of juvenile UWR chinook salmon in the McKenzie River from 1986-1992, juvenile migration timing appears to have changed over this time period. Samples collected at various locations between 1948 and 1968 indicated that fry migration occurred primarily from March through June (USACE 2000).

Since 1980, fry have migrated past Leaburg Dam primarily during January through April, earlier than in previous years. The fingerling migration, which originally peaked during January through March, now peaks during October and November. The change in juvenile migration timing may be due to the release of warm water from impoundments above spawning areas during the fall incubation period, accelerating fry emergence and movement (USACE 2000).

### *4.1.3 Ocean Stage and Age at Maturity*

UWR chinook salmon are "Gulf of Alaska" migrants. They migrate to the north upon ocean entry and are subject to harvest in British Columbia and southeast Alaska ocean fisheries. Unlike upriver Columbia spring chinook salmon, UWR chinook salmon appear to be highly vulnerable to ocean fisheries. Few adult Willamette spring chinook salmon are caught in Oregon or California ocean fisheries. Commercial seasons are typically not open when the adults are off the coast of Oregon, in preparation for entering the Columbia River during January through May, and few to none, depending on the brood year, are taken off the California coast (USACE 2000).

Mattson (1962) analyzed scales taken from spring chinook salmon caught by sport fishermen in the lower Willamette River during 1946-1950, when most of the returning fish were naturally-produced and the run was comprised of a substantial number of returning adults that were five and six years old. In comparison, data from the lower Willamette River and Clackamas River fisheries in more recent years indicate that there has been a decrease in the presence of older age classes among returning adult spring chinook salmon since the late 1940s. There has been a steady decline in the proportion of older fish (i.e., age-5 and age-6) over the period 1946 to 1983. The age composition of spring chinook salmon runs returning to the Clackamas and Willamette rivers is currently dominated by age-4 fish (USACE 2000).

## *4.2 Status of the Species*

The following sections describe the current status of each population within the UWR ESU and for the ESU as a whole. The action area for this consultation is from the upstream end of the Carmen and Smith reservoirs on the McKenzie and Smith rivers (respectively), downstream to the confluence of the McKenzie and Willamette rivers. Therefore, the proposed action affects only the McKenzie subbasin population of UWR chinook salmon. Spawning habitats used by Clackamas, Molalla, North and South Santiam, Calapooia, and Middle Fork Willamette populations are not affected by project operations. Due to this difference, the current status of the McKenzie population is described in more detail than for the other populations.

### *4.2.1 Population-level Status*

The following descriptions for population-level status of the Clackamas, North and South Santiam, Calapooia, and Middle Fork Willamette subbasin populations of UWR chinook salmon were developed by NOAA Fisheries' West Coast Salmon Biological Review Team (BRT) for the current status review for listed ESUs of West Coast salmon and steelhead (BRT 2003).

#### *4.2.1.1 Clackamas*

The total number of chinook salmon passing above the North Fork Dam has exceeded 1,000 in most years since 1980, and the last several years show large increases. However, the majority of these fish are likely of hatchery origin (Cramer 2002). The only year for which hatchery origin estimates are available is 2002 (64% of hatchery origin). Although the majority of spring chinook salmon spawning habitat is above North Fork Dam, spawning is also observed below the dam, mostly by hatchery-origin spawners. The population has shown substantial increases in total abundance (mixed hatchery and natural origin) in the last two years (2002 and 2002).

#### *4.2.1.2 Molalla*

A 2002 survey of 16.3 miles of stream in the Molalla found 52 redds. However, 93% of the carcasses recovered in the Molalla in 2002 were fin-clipped and of hatchery origin (Schroeder et al. 2002). Fin-clip recovery fractions for spring chinook salmon in the Willamette tend to underestimate the proportion of hatchery origin spawners, so the true fraction is likely in excess of 93 % (i.e., near 100%). The Molalla natural spring chinook salmon population is believed to be extirpated, or nearly so.

#### *4.2.1.3 North Santiam*

Estimates of the historical abundance of spring chinook salmon in the North Santiam subbasin range from 8,250 adults in 1934, excluding fish that spawned downstream of the current site of Detroit Reservoir (e.g., in the lower mainstem North Santiam River and the Little North Santiam River) (Wallis 1963), to 2,830 in 1947 for the subbasin as a whole (Mattson 1948). Parkhurst et al. (1950) estimated that habitat could accommodate at least 30,000 adults. Based on the proportion of marked hatchery adults at return versus release, ODFW (1995) concluded that less than 300 naturally-produced UWR chinook salmon adults returned to the subbasin in 1994. Lindsay (2003, see below) reported that, based on the otolith data, 4% of the spring chinook salmon carcasses collected between the Upper and Lower Bennett dams and Minto (including the Little North Santiam River) in 2000 were wild fish, 2% in 2001, and 8% in 2002. Firman et al. (2002) estimated a natural-origin run of spring chinook salmon to the North Santiam subbasin of 1,233 fish in 2002, based on passage at Upper and Lower Bennett dams, counts of naturally-spawned carcasses, and the number of unmarked fish taken for hatchery broodstock at the Minto trap. This population is not considered self-sustaining (BRT 2003).

#### *4.2.1.4 South Santiam*

Mattson (1948) estimated an escapement of 1,300 spring chinook salmon to the South Santiam River in 1947. USFWS (1963) reported an annual spawning run of about 1,400 above the current site of Foster Dam. About 70% of these were destined for the Middle Santiam River (above the current site of Green Peter Dam), 7% spawned in the reach that is now under Foster Reservoir, and 23% spawned in the South Santiam River above Foster. Thompson et al. (1966) estimated a total annual run size (natural- and hatchery-origin) of 3,700 adults during the 1960s. Estimates based on the sport catch and returns to Foster Dam indicate that the minimum total (natural- plus hatchery-origin) run size to the subbasin during the 1970s and 1980s varied from less than 500 to nearly 10,000 per year.

Spawning ground survey data reported in Lindsay et al. (1998) indicated a total of 163 spring chinook salmon redds in the South Santiam below Foster Dam during September 1998. Firman et al. (2002) estimated a natural-origin run of spring chinook salmon to the South Santiam subbasin of 965 fish in 2002, based on counts of naturally-spawned carcasses and the number of unmarked fish taken for hatchery broodstock at Foster Dam. Based on otoliths, Lindsay (2003) found that 14% of the spring chinook salmon carcasses collected between Waterloo and Foster in 2002 were naturally-spawned fish. This population is not considered self-sustaining (BRT 2003).

#### *4.2.1.5 Calapooia*

A 2002 survey of 11.1 miles of stream in the Calapooia River above Brownsville found 16 redds (Schroeder et al. 2002). The carcasses recovered in the Calapooia in 2002 were too decomposed to determine the presence or absence of fin clips; however, it was assumed that all the fish were surplus hatchery fish outplanted from the South Santiam hatchery (Schroeder et al. 2002). The Calapooia natural spring chinook salmon population is believed to be extirpated, or nearly so.

#### *4.2.1.6 McKenzie*

<u>Abundance</u>
Spring chinook salmon escapement to Leaburg Dam has varied over the last 30+ years, with the 1988 through 1991 runs the strongest recorded (Table 4-1). However, until 2001, it was difficult to distinguish naturally-produced spawners from hatchery-produced fish, so these data may not represent the status of the wild population over time.

<u>Harvest</u>
General effects of ocean and freshwater fisheries on spring chinook salmon returning to the Willamette River are as described in section 4.3.1.3. The average harvest rate on the McKenzie stock was approximately 40% from 1970 through 2001, and ranged as high as 52% in several years. Under the recently completed amendments to the Pacific Salmon Treaty (specifically the chinook salmon amendment, which addresses harvest through 2008), future ocean harvest rates are likely to be in the range of 10% to 20%.

Due to low returns to areas above Willamette Falls, the freshwater fishery has been managed more conservatively since 1996. The McKenzie River was closed to salmon angling for most of 1996 through 2001, but then reopened below Leaburg Dam to allow harvest of hatchery (fin-clipped) returns. The expanded marking program and directed fishery are expected to reduce the average annual harvest rate on wild spring chinook salmon from 32.8% to less than 8%. ODFW's Fisheries Management and Evaluation Plan (FMEP) for spring chinook salmon anticipates 5-year evaluations with possible changes in harvest rates to ensure that the objectives of the FMEP are achieved. However, the FMEP is intended to remain in effect indefinitely.

Table 4-1. Estimated return of spring chinook salmon to the McKenzie River and Leaburg Dam (ODFW 2001b; Ziller 2002; Firman et al. 2002).

| Run Year | Total Escapement to McKenzie River | % of Total Escapement Over Willamette Falls | Escapement to Leaburg Dam | % (No.) Naturally-Produced Fish in Leaburg Dam Escapement |
|---|---|---|---|---|
| 1970 | 4,787 | 14.0 | 2,991 | N/A |
| 1971 | 6,323 | 14.2 | 3,602 | |
| 1972 | 3,770 | 14.4 | 1,547 | |
| 1973 | 7,938 | 18.9 | 3,870 | |
| 1974 | 7,840 | 17.6 | 3,717 | |
| 1975 | 3,392 | 17.8 | 1,374 | |
| 1976 | 4,275 | 19.3 | 1,899 | |
| 1977 | 9,127 | 22.8 | 2,714 | |
| 1978 | 8,142 | 17.1 | 3,058 | |
| 1979 | 3,018 | 11.3 | 1,219 | |
| 1980 | 4,154 | 15.4 | 1,980 | N/A |
| 1981 | 3,624 | 12.0 | 1,078 | |
| 1982 | 5,413 | 11.7 | 2,241 | |
| 1983 | 3,377 | 11.0 | 1,561 | |
| 1984 | 4,739 | 10.9 | 1,000 | |
| 1985 | 4,930 | 14.3 | 825 | |
| 1986 | 5,567 | 14.2 | 2,061 | |
| 1987 | 7,370 | 13.4 | 3,455 | |
| 1988 | 12,637 | 17.9 | 6,753 | |
| 1989 | 10,020 | 14.5 | 3,976 | |
| 1990 | 12,743 | 17.9 | 7,115 | |
| 1991 | 11,553 | 22.0 | 4,359 | |
| 1992 | 8,976 | 21.4 | 3,816 | |
| 1993 | 8,148 | 25.5 | 3,617 | |
| 1994 | 2,992 | 11.5 | 1,526 | 54 (825) |
| 1995 | 3,162 | 15.4 | 1,622 | 57 (933) |
| 1996 | 3,640 | 16.8 | 1,445 | 76 (1,105) |
| 1997 | 3,110 | 11.6 | 1,176 | 84 (991) |
| 1998 | 3,997 | 11.6 | 1,874 | 77 (1,415) |
| 1999 | 4,557 | 11.3 | 1,909 | 72 (1,383) |
| 2000 | 6,804 | 16.4 | 2,657 | 75 (1,985) |
| 2001 | 9,548[1] | 17.7 | 4,428 | 76 (3,380) |
| 2002 | 4,470[2] | | | |

[1] Includes an estimated 750 fish harvested below Leaburg Dam.

[2] Based on counts at Leaburg Dam, counts of naturally-spawned carcasses, and the # of unmarked fish taken for broodstock at Leaburg hatchery.

Population Growth Rate and Productivity

McClure et al. (2000b) estimated the median population growth rate ($\lambda$) for the aggregate UWR chinook salmon population above Leaburg Dam, using a range of assumptions about the relative effectiveness of hatchery fish. Assuming that hatchery fish spawning in the wild have not produced adult returns (i.e., hatchery effectiveness = 0), the median population growth rate over the base period (1980 through 1998) was 1.03 (Table B-5 in McClure et al. 2000b). If hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 1.0), the median population growth rate was 0.88 (Table B-6 in McClure et al. 2000b). Based on these estimates, the risk of absolute extinction for the aggregate subbasin population ranged from 0.01 (hatchery effectiveness = 0) to 0.85 (hatchery effectiveness = 1.0) (see Table 4-3 below; also Tables B-5 and B-6, respectively, in McClure et al. 2000b). Lindsay (2003) reported that in 2002, 55% of the spring chinook salmon carcasses in the mainstem McKenzie between Leaburg Dam and the Carmen-Smith spawning channel, and in the South Fork McKenzie below Cougar Dam, were wild fish. This compares to an estimated 67% in 2001.

Table 4-2. Risk of absolute extinction (one fish per generation) in 24, 48, and 100 years for UWR chinook salmon in the McKenzie River above Leaburg Dam over a range of hatchery effectiveness values.[1]

| | **Hatch = 0** | **Hatch = 0.2** | **Hatch = 0.8** | **Hatch = 1.0** |
|---|---|---|---|---|
| 24 years | 0.00 | 0.00 | 0.01 | 0.01 |
| 48 years | 0.00 | 0.01 | 0.18 | 0.28 |
| 100 years | 0.01 | 0.10 | 0.72 | 0.85 |

[1] Data for relative effectiveness of hatchery fish equal to 0%, 100%, 20%, and 80% from Tables B-5, B-6, B-11a, and B-11b, respectively, in McClure et al. 2000b).

NOAA Fisheries estimated the needed incremental change from base period survival for UWR chinook salmon in the McKenzie River above Leaburg Dam to meet the survival and recovery indicator criteria (Appendix A in NMFS 2000b). This aggregate population must achieve an incremental increase in survival of 9% to 65% (depending on the relative effectiveness of hatchery fish) to reduce the risk of extinction within the next 100 years to 5% (Table 4-2). An incremental increase in survival of >4% to >59% must occur for the median population growth rate to increase to >1.0.

Table 4-3. Needed incremental change from base period survival to achieve a 5% risk of extinction in 100 years and median population growth rate ($\lambda$) >1.0 over 48 years for UWR chinook salmon in the McKenzie River above Leaburg Dam over a range of hatchery effectiveness values (from Tables A-3 and A-6 in NMFS 2000b).

| | **Historical Effectiveness of Hatchery Spawners** | |
|---|---|---|
| **Needed Change in Survival to Achieve:** | **Hatch = 0.2** | **Hatch = 0.8** |
| 5% Risk of Extinction $_{(100\ yrs)}$ | 9.17 | 65.21 |
| Lambda > 1.0 $_{(48\ yrs)}$ | >4.55 | >59.48 |

NOAA Fisheries expects measures required through two completed consultations to improve the population growth rate for the McKenzie subbasin population under the environmental baseline. The expanded marking program will reduce the average annual adult harvest rate on wild spring chinook salmon from 32.8% to less than 8%,[1] resulting in an incremental increase in survival of 37%. This estimate, 37%, is within the range that NOAA Fisheries has determined is needed to meet both the survival and recovery indicator criteria. This means that, if hatchery-origin fish that spawned naturally during the base period were relatively unsuccessful at producing adult returns compared to natural-origin spawners (hatch = 0.2), the McKenzie River population of UWR chinook salmon is likely to at least stabilize over the next 48 years and is not likely to go extinct over the next 100 years. However, if hatchery-origin fish that spawned naturally during the base period were nearly as successful as wild-origin spawners (hatch = 0.8), it is unlikely that the population will survive or recover. As described in NMFS (2000b), information regarding the effectiveness of hatchery-origin spawners is sparse and insufficient to distinguish among these alternative assumptions.

During much of the base period (i.e., through 1996, when EWEB instituted the interim flow agreement), smolts entrained into the Walterville Canal and powerhouse experienced mortality rates up to 14.5%. Based on the FERC license articles reviewed by the Services' in their joint biological opinion, "On the Effects of the Relicensing of EWEB's Leaburg-Walterville Hydroelectric Project in the McKenzie Subbasin, Oregon" (signed September 21, 2001), EWEB screened the Walterville Canal in 2002. NOAA Fisheries expects the residual mortality of UWR chinook salmon smolts to range from 0 to 0.5%. If all smolts passing through the Walterville reach entered the canal, using the more conservative assumption that mortality after screen installation would be 0.5%, the incremental change in survival would be approximately 16.4%.

However, all of the smolts that passed through the Walterville reach were not entrained into the canal and powerhouse, even before a 1996 flow agreement. Making a conservative assumption that, during most of the base period, 50% of total flow was diverted into the canal during the

[1] The actual impact of the 2001 freshwater fishery on wild McKenzie River spring chinook salmon was a fishing mortality rate of 8.27% (ODFW 2002), based on visual stock identification and coded-wire tag analyses.

smolt migration, NOAA Fisheries' best estimate of the additional incremental increase in survival for the population due to this action is approximately 8.2%. Combined with an estimated 37% survival improvement from the selective harvest measure, screening the Walterville Canal will provide a survival improvement within the range needed to meet NOAA Fisheries' survival and recovery criteria.

Juvenile Outmigrant Production

Zakel and Reed (1984), Homolka and Downey (1995), and Kenaston (2003) have documented juvenile outmigrant production in the McKenzie subbasin. Seasonal patterns of outmigration are described under Timing of Emergence and Juvenile Outmigration, below. Data are not adequate to determine trends in juvenile outmigrant production over time.

Population Spatial Distribution

Historical spawning areas included the mainstem McKenzie River, Smith River, Lost Creek, Horse Creek, South Fork, Blue River, and Gate Creek (Mattson 1948; Parkhurst et al. 1950). Parkhurst et al. (1950) estimated that there was suitable habitat for 80,000 fish in the McKenzie River basin. Construction of Cougar Dam at RM 4.5 on the South Fork McKenzie River in 1963 blocked access to at least 25 miles of spawning habitat. Although Cougar Dam was built with fish passage facilities, these did not function as intended and were no longer used for this function after 1966. Construction of Blue River Dam (at RM 1.8 in 1968) blocked a smaller amount of habitat; the Blue River watershed probably supported a historical population of about 200 adult chinook salmon (WNF BRRD 1996).[2] EWEB's Carmen-Smith Project blocked approximately 7 miles of historical chinook salmon spawning habitat.

The McKenzie subbasin supports the largest existing population of UWR chinook salmon. Downstream of Leaburg Dam, most spring chinook spawners are hatchery-produced (USACE 2000). Based on aerial redd surveys, approximately 10% to 20% of the chinook salmon that spawn above Leaburg Dam use the lower few miles of the South Fork McKenzie River (i.e., below Cougar Dam); 30% to 40% spawn in the mainstem McKenzie below the confluence with the South Fork; and 45% to 60% spawn in headwater areas above the mouth of the South Fork up to Trail Bridge Dam (USFWS 1994; ODFW 1999).

*Carmen-Smith Spawning Channel*

EWEB completed construction of its Carmen-Smith Project on the upper mainstem McKenzie River in 1963. Of the three dams that comprise the Carmen-Smith Project, Trail Bridge Dam cut off access to about 4 miles of historical spring chinook salmon spawning habitat and Smith Dam cut off about 3 miles. Carmen Dam is above a natural barrier to migration (Tamolich pool and falls).

[2] Prior to construction of Blue River Dam, a 9-foot falls at RM 2.5 and numerous low falls above RM 6 were passable only with difficulty and effectively formed a natural barrier to spring chinook salmon migration (Parkhurst et al. 1950).

When the Carmen-Smith Project was completed in 1963, a spawning channel was constructed downstream of Trail Bridge Dam to mitigate for blocking spring chinook salmon access to spawning and rearing habitat upstream of Trail Bridge Reservoir. A velocity barrier just upstream of the channel entrance prevents adult spring chinook salmon from entering the tailrace area of Trail Bridge powerhouse. The spawning channel was designed to accommodate between 100 and 200 spawners. The numbers of redds in the Carmen-Smith spawning channel follow the same general pattern as redd counts in the upper McKenzie River mainstem (Figure 4-1). Over 50 redds were counted in the spawning channel in both 2001 and 2002. Peak daily fish counts (live fish + spawned carcasses) in the channel were 133 in 2001 and 159 in 2002. Fish counts in the previous three years were 25, 23, and 27 in 1998, 1999, and 2000, respectively.[3]

[3]While it is possible that the elevated numbers in the spawning channel in recent years simply reflect increases in overall run size to the McKenzie, it is also possible that some of these spawners are progeny of the hatchery outplants released by ODFW in the mid-1990s that survived passing downstream through Trail Bridge Dam and successfully matured into returning adults. In a 1992 letter to EWEB (NMFS 1992), NOAA Fisheries suggested that production from the spawning channel may be limited by a lack of suitable rearing habitat within the channel and predation within the channel.

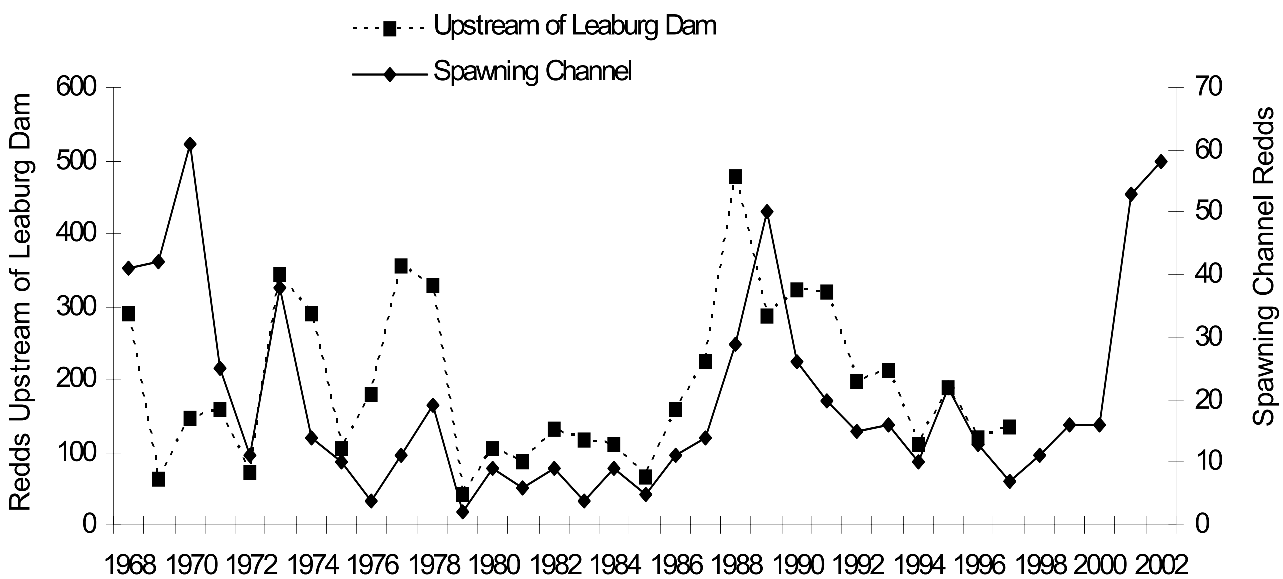


Figure 4-1. Mainstem spring chinook salmon redd counts upstream of Leaburg Dam and within Carmen-Smith spawning channel, 1968-2002 (no upstream surveys conducted after 1998).

*Risk of Natural and Manmade Catastrophes*
Good and Fabri (2002, Appendix L in W/LC TRT Dec. 2 draft viability analysis) reported the following risks of catastrophic loss for McKenzie subbasin spring chinook salmon:

- Volcanic activity (from Three Sisters) – Medium.
- Earthquakes – Low.
- Landslides (based on geology and precipitation patterns) – Medium.
- Disease epidemics (due to hatchery releases) – Medium.
- Pollution (related to roadway/transportation spills) – Negligible.

This information is considered in NOAA Fisheries' analysis of effects of the proposed action on the viability of UWR chinook salmon in the McKenzie subbasin.

<u>Diversity</u>

*Timing of Adult Migration and Spawning*
The timing of the run in the McKenzie River is monitored at Leaburg Dam, where passage usually peaks in June (Howell et al. 1988). A smaller pulse moves above the dam during the September spawning period. The period of peak passage appears to be temperature dependent, occurring as early as the second half of May in warmer water years and as late as the first part of July in cooler years (NMFS and USFWS 2001). Combining spawning ground counts with carcass data, Homolka and Downey (1995) calculated that spring chinook salmon upstream of Leaburg Dam spawned from very late August until mid-October in 1992, with the peak centered on September 23 (midpoint of median week on September 16). In comparison, from 1902 through 1907, hatchery operations on the McKenzie began egg takes in early-to mid-August, and peak egg collections generally occurred during the second week of September (Howell et al. 1988, cited in Homolka and Downey 1995). Homolka and Downey (1995) thought that the spawn timing observed in 1992 was a considerable shift from the historical pattern.

Ingram and Korn (1969) reported that the timing of adult chinook salmon reaching the Cougar Dam trap and haul facility changed after the project was completed in 1964. About 60% of the run passed upstream in June during the 4 years before impoundment, but almost all passed upstream after June in 1964, 1965, and 1966. The run peaked in June 1967 when water releases from Cougar were manipulated to enhance passage, similar to the preimpoundment years (1960 through 1963).

*Timing of Emergence and Juvenile Outmigration*
Homolka and Downey (1995) calculated emergence dates for spring chinook salmon in the South Fork McKenzie based on U.S. Geological Survey (USGS) temperature data for 1992. Temperatures were below the median lethal high temperature for chinook salmon eggs (61°F; 16°C), indicating that eggs would incubate quickly but not necessarily die. Homolka and Downey predicted that fry spawned during the median spawning week, which was centered on

September 15, 1992, would emerge 57+ days earlier than fry from eggs incubated in Lost Creek and 99+ days earlier than fry incubated in Horse Creek, two unregulated tributaries to the upper McKenzie River (1995). Warm water out of Cougar and Blue River reservoirs also affected emergence timing in the mainstem McKenzie some distance below the South Fork and Blue River; the calculated emergence date for redds in the South Fork below Cougar Dam was 36+ days earlier than for redds 6 miles below the mouth of the South Fork near Finn Rock. This pattern was generally supported by field sampling. Holmolka and Downey (1995) began catching fry in the lower South Fork in early December and in the mainstem just below the South Fork during late January, but did not catch the first emergent fry upstream of the South Fork until late January through mid-March. In 2002, 51% of the 922 redds counted in the McKenzie basin were below Cougar Reservoir on the South Fork McKenzie (Schroeder et al. 2002) and were influenced by these warmer water temperatures.

Each year class of juvenile McKenzie spring chinook salmon demonstrates multiple distributional migrations, varying in nature between years. Zakel and Reed (1984) defined three life history types of wild chinook salmon at Leaburg Dam: age-0 fry that migrate in late winter through early spring, age-0 fingerlings that migrate in the fall, and yearling smolts that migrate in early spring. During the spring after emergence, an unknown proportion of fry from the upper subbasin pass Leaburg Dam and seed-rearing areas in the lower McKenzie and Willamette rivers. Juveniles of this species have been observed passing Willamette Falls as fry, but most rear in the lower McKenzie and throughout the mainstem Willamette system. Subyearling fingerlings pass Leaburg Dam in the late summer and fall in a second distributional migration from the upper watershed. Some subyearlings PIT-tagged in the lower McKenzie and Willamette rivers during summer were detected at Willamette Falls that fall (Schroeder et al. 2002). Some subyearlings have been observed in off-channel areas of the Willamette and the lower reaches of valley floor tributaries; movements that may be timed to co-occur with (or may be triggered by) fall and early winter freshets, which flood habitat that would be unsuitable during summer due to high temperatures and low flow (Kenaston 2003). ODFW found that fingerlings penetrated up some valley floor tributaries as far as 20 miles from the mainstem. Most of the subyearlings PIT-tagged at Leaburg Dam during fall passed Willamette Falls the next spring (March through May), but there was some variation in this pattern as well; some of the fall migrants tagged at Leaburg Dam were detected at Willamette Falls in November and December. Finally, the passage of migrating yearlings PIT-tagged at Leaburg Dam during spring peaked at Willamette Falls that May. The median transit time for PIT-tagged yearlings from Leaburg Dam to Willamette Falls was 46 days in 2001 and 53 days in 2002 (Schroeder et al. 2001; Schroeder et al. 2002). In comparison, the median travel time to Willamette Falls for juvenile spring chinook salmon released from the Leaburg Hatchery was 6 days.

*Genetic Diversity*
Genetic analysis of juveniles from the McKenzie River indicated that the naturally-produced fish were most closely related to other naturally- and hatchery-produced spring-run chinook salmon from the upper Willamette and Clackamas rivers (NMFS 1998).

*Hatchery Production and Interactions with Wild-Origin Fish*
A number of hatcheries have operated on the McKenzie River since the early 1900s. The McKenzie River Salmon Hatchery, located on Highway 126 between Leaburg and Vida, collects returning hatchery adults and some spring chinook salmon of natural origin. The broodstock for this program originated from fish collected upstream at the Leaburg Trout Hatchery (near Leaburg Dam) and from mainstem reaches and tributaries of the McKenzie River. Relatively few intrabasin transfers have been received compared to other UWR chinook salmon hatchery stocks. ODFW's (1998) Willamette Basin Fish Management Plan called for incorporating 10% to 25% natural-origin fish into the broodstock each year. However, until 2001, when all of the hatchery fish (through age 5) returning to the McKenzie were fin-clipped, the unmarked fish collected for broodstock may have included some of hatchery origin. Since 1996, the percentage of the broodstock of known natural origin has ranged from 9% to 25% (Kruzic 2003); according to ODFW (2003), an average of at least 15% wild fish has been incorporated into the McKenzie Hatchery broodstock each year since 1997. NOAA Fisheries' biological opinion on the U.S. Army Corps of Engineers' (USACE) hatchery program for UWR chinook salmon will expire in September 2003.

Conversely, the rate of spawning by hatchery chinook salmon in the wild has been high; hatchery fish constituted 63%, 59%, and 47% of the natural spawners below Leaburg Dam in 1990, 1994, and 1995, respectively (Willis et al. 1995). Lindsay et al. (1998) found that coded wire tags collected from carcasses in the McKenzie River below Leaburg Dam included strays from Clackamas and South Santiam hatchery stocks that had been transferred to McKenzie Hatchery for rearing, but were then released in the Clackamas and South Santiam subbasins. Similar recoveries of non-McKenzie hatchery stock were made in 1997 (Lindsay et al. 1997). To limit introgression of hatchery fish into the naturally-spawning population, NOAA Fisheries directed the Federal action agencies for the Willamette basin hatchery program (i.e., USACE and Bonneville Power Administration) to limit the number of hatchery-origin fish allowed to pass above Leaburg Dam (NMFS 2000). However, the Leaburg trap has been inadequate for removing all the hatchery fish during the peak of the run without some level of injury to natural-origin fish.[4]

ODFW also operates hatchery programs for summer steelhead and rainbow trout in the McKenzie River, and these fish may interact with the native spring chinook salmon population. Hatchery summer steelhead are released below Leaburg Dam to prevent interactions with wild spring chinook salmon in the core spawning areas for wild fish above Leaburg Dam. Hatchery rainbow trout are stocked above Leaburg Dam and NOAA Fisheries has identified both competition with, and predation by, hatchery trout as a concern for the native chinook salmon population (NMFS 2000) . The USACE is currently funding a study by ODFW researchers to

[4]USACE, ODFW, and EWEB are currently developing plans to improve the Leaburg ladder trapping facility.

determine whether and to what extent adverse effects may occur.

*Summary*
Based on the abundance and productivity criteria, the BRT (2003) considered the McKenzie population to be the only viable population of UWR chinook salmon. However, the BRT was somewhat uncertain about the long-term sustainability of even this population, because numbers have been in the low thousands. According to Lindsay (2003), about 40% of the population was made up of hatchery spawners in 2001 and 2002. The BRT thought that the substantial increase in abundance in recent years could be a result of increased ocean survival, which is likely to vary in the future.

#### *4.2.1.7 Middle Fork Willamette*

Historically, the spring chinook salmon run in the Middle Fork subbasin may have been the largest above Willamette Falls (Hutchison 1966; Thompson et al. 1966). Based on egg collections at the Willamette River Hatchery (Dexter Ponds, 1909 to the present), the largest egg collection, 11.3 million in 1918 (Wallis 1962), would correspond to 3,559 females (@ 3,200 eggs/female). This leads to an estimated minimum run size of approximately 7,100 adult spring chinook salmon for the area that is now above Lookout Point Dam (assuming a 1:1 sex ratio). This estimate does not include fish that spawned downstream of the hatchery rack (such as in the mainstem Middle Fork Willamette below Dexter and in the Fall Creek watershed). Mattson (1948) estimated a run size of 2,550 naturally-produced spring chinook salmon to the Middle Fork Willamette River in 1947. USFWS (1962) reported that approximately 450 spring chinook salmon spawned above the site of Fall Creek Dam in the years immediately before construction (the project was completed in 1966). Firman et al. (2002) estimated a natural-origin run of spring chinook salmon to the Middle Fork Willamette subbasin of 987 fish in 2002, based on counts of naturally-spawned carcasses and the number of unmarked fish taken for hatchery broodstock at Dexter Dam.

From 1953 through 1966 (after construction of Dexter and Lookout Point Dams blocked access to the historical spawning grounds), an average of 3,502 chinook salmon were caught in the trap at the base of Dexter Dam. These total counts probably included some hatchery-origin fish. Thompson et al. (1966) estimated a total population of 6,100 naturally- and artificially-produced adults in Middle Fork Willamette subbasin in the mid-1960s.

A small amount of natural production probably occurs from spawning both above and below the dams but is based on ODFW's releases of hatchery-origin adults into the upper Middle Fork above Hills Creek Reservoir since 1992 and into the North Fork of the Middle Fork above Lookout Point Reservoir since 1999. Natural spawning occurs in the mainstem Middle Fork Willamette below Dexter Dam, although ODFW investigations indicated that warm water temperatures cause eggs to succumb to fungus infections, and those eggs that do survive produce juveniles that emerge early (Ziller et al. 2002), above and below Fall Creek Dam. This population is not considered self-sustaining (BRT 2003).

### *4.2.2 BRT's Conclusion on Status of Upper Willamette River Chinook Salmon*

Although the number of adult spring chinook salmon crossing Willamette Falls is in the same range (about 20,000-70,000) that it has been for the last 50 years, a large fraction of these are hatchery produced. The BRT was concerned that perhaps a third of the historic habitat used by fish in this ESU is currently inaccessible behind dams, and that natural production in this ESU is restricted to a very few areas. Increases in the last 3-4 years in natural production in the largest remaining population (the McKenzie) were considered encouraging. With the relatively large incidence of hatchery fish, it is difficult to determine trends in natural production.

## *4.3 Factors for Decline*

### *4.3.1 Habitat and Hydrology*

Human activities have had enormous effects on salmonid populations in the Willamette drainage. The Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat (i.e., stream shoreline) by as much as 75%. In addition, the construction of 37 dams in the basin has blocked access to over 700 km of stream and river spawning habitat. Some of these dams also alter the temperature regime of the Willamette and its tributaries, affecting the timing of development of naturally-spawned eggs and fry. Water quality is also affected by agricultural and urbanization on the valley floor, as well as timber harvesting in the Cascade and Coast ranges, which contribute to increased erosion and sediment load in Willamette basin streams and rivers. The disappearance in the 1920s and 1930s of the June run was associated with a dramatic decline in water quality in the lower Willamette River. The fall run in the Clackamas River was extirpated during this same time period.

### *4.3.2 Hatcheries*

Hatchery production began in the basin during the late nineteenth century. Eggs were transported throughout the basin so that, in terms of genotype, current populations are relatively homogeneous (although still distinct from those of surrounding ESUs). Hatchery production continues in the Willamette, with an average of 8.4 million smolts and fingerlings released each year into the main river or its tributaries between 1975 and 1994. Hatcheries are currently responsible for most of the production (90% of escapement) in the basin.

The Clackamas River currently accounts for about 20% of the production potential in the Willamette River basin with fish originating from one hatchery plus natural production areas primarily above the North Fork Dam. The interim escapement goal for that area is 2,900 fish (ODFW 1998a). However, the Clackamas River system is so heavily influenced by hatchery production that it is difficult to distinguish spawners of natural stock from hatchery origin fish. Approximately 1,000 to 1,500 adults have been counted at the North Fork Dam in recent years.

### *4.3.3 Other Factors for Decline*

Harvest on this ESU has been high, both in the ocean and in-river. The total in-river harvest below Willamette Falls during 1991 through 1995 averaged 33% (and previously had been much higher in some years). Ocean harvest was estimated as 16% for 1982 through 1989. Total (marine and freshwater) harvest rates on UWR spring-run stocks were reduced considerably for the 1991 through 1993 brood years, to an average of 21% (ODFW 1998b). As described in section 4.2.1.6, under the recently completed amendments to the Pacific Salmon Treaty, future ocean harvest rates are likely to be in the range of 10% to 20%. Under ODFW's FMEP, the freshwater fishery is managed so as not to exceed a handling mortality rate of 15% and an average fishery rate of 10% to 11% (ODFW 2001a).

# 5. ENVIRONMENTAL BASELINE

In step 2 of the analysis, NOAA Fisheries evaluates the relevance of the environmental baseline within the action area to the species' current status and the status of the species' biological requirements. The environmental baseline reflects "the past and present effects of all Federal, state, or private activities in the action area, the anticipated effects of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the effect of state or private actions which are contemporaneous with the consultation in process" (50 CFR 402.02).

## *5.1 Method of Evaluating the Environmental Baseline*

In section 1.2.1, the biological requirements of UWR chinook salmon and steelhead were defined as successful adult holding, spawning, incubation, rearing, and growth and development, and the habitat needed to support each stage. In many cases, NOAA Fisheries must describe the status of the species' biological requirements in terms of habitat condition in order to infer the populations' response to the effects of the action. Habitat within the action area that is in properly functioning condition would support successful adult holding, spawning, incubation, rearing, and growth and development to the smolt stage, thus meeting the freshwater component of the species' biological requirements. In this Opinion, NOAA Fisheries uses a matrix (described in section 1.2.1) to describe the status of several characteristics of the following habitat elements relative to properly functioning condition: flow and hydrology; safe passage and access to historical habitat; riparian vegetation and floodplain function; large wood, sediment transport, and channel complexity; and water quality. For each habitat characteristic in the properly functioning condition framework, baseline environmental conditions are described as "properly functioning," "at risk," or "not properly functioning." The status of each habitat characteristic has consequences for population viability (i.e., through effects on abundance/productivity, juvenile outmigrant production, spatial distribution, and life-history diversity).

In section 5.3, NOAA Fisheries compares the current status of each population, as affected by habitat conditions, to the population-level viability guidelines in section 1.2.1, to determine whether biological requirements are met under the environmental baseline.

## *5.2 Habitat Condition in the Action Area*

In this section, NOAA Fisheries describes properly functioning condition for habitat characteristics, current (baseline) conditions relative to properly functioning condition, and the source of the baseline condition.

### *5.2.1 Description of the McKenzie Subbasin*

The McKenzie River is approximately 90 miles long and drains an area of about 1,300 square miles. Major tributaries are Horse Creek and the South Fork McKenzie, Blue, and Mohawk rivers. The McKenzie River headwaters are characterized by a broad, gently sloping volcanic ridge that extends west from the Three Sisters Mountains. Much of the subbasin is mountainous with steep ridges and a narrow band of level land in the valleys along the lower McKenzie and Mohawk rivers.

### *5.2.2 Disturbance Regime and Land Cover*

The general relationships between disturbance regime and land cover and the biological requirements of UWR chinook salmon are described in Spence et al. (1996). Table 5-1 shows habitat characteristics of disturbance regime and land cover, and their status in the McKenzie subbasin under the environmental baseline. The status of each of these habitat characteristics is described in more detail below.

Table 5-1. Properly functioning condition with respect to forest disturbance regime, and land cover in the McKenzie subbasin, status under the environmental baseline, and cause of the baseline condition.

| Habitat Characteristic | Properly Functioning Condition | Environmental Baseline Conditions Relative to Properly Functioning Condition | Cause of Baseline Condition |
|---|---|---|---|
| Forest disturbance regime and successional stage | Forest disturbance regime and successional stage that create a mosaic of early-, mid-, and late-successional forests, dominated by late-successional forests<br>• Natural forest disturbances are caused by fire, insects, debris torrents, and disease<br>• Natural forest disturbances (e.g., debris torrents and fire) deliver both sediment and large wood to streams concurrently, forming quality aquatic habitat over time | • Disturbance regime is dominated by timber harvesting<br>• Forests are dominated by early- to mid-successional stages, with some late-successional forests in wilderness areas in the Horse Creek and South Fork drainages<br>• Timber harvesting has increased sediment delivery to streams, but decreased large wood input, resulting in degraded aquatic habitat | • Fire suppression<br>• Timber harvesting |
| Land cover | Land cover that contains coniferous forests at higher elevations and prairie, woodland, oak savannah, and deciduous forest with intact riparian areas in lower elevations:<br>• Land contains and/or is managed for pre-settlement ecosystems and disturbance processes can maintain aquatic habitat | • Upper watershed is forested, but some is managed for timber production rather than ecosystem health<br>• Lower watershed contains extensive agricultural, urban, and residential development | Conversion to agricultural, urban, residential, and rural uses |

About 70% of the McKenzie River subbasin is comprised of Federal land managed by the WNF and the Eugene District of the Bureau of Land Management. The WNF owns 99% of the upper McKenzie watershed, which consists of Western hemlock, Mountain hemlock, and Pacific silver fir plant associations primarily in late successional stages. The channel slope decreases from 1.2% upstream of Belknap Springs to less than 0.4% through the glacial valley just upriver of Blue River. Vast areas of porous lava in the headwaters of the system retard surface runoff and act as a reservoir for large, relatively constant-flowing springs. Downstream of the confluence between the McKenzie River and Blue River, the channel slope remains between 0.2% and 0.4%, but the channel is tightly confined within a narrow canyon for approximately 20 miles. The slope flattens to less than 0.2 % when the river enters the Willamette Valley.

The headwaters of both Horse Creek and the South Fork McKenzie River originate in the Three Sisters Wilderness Area, and are dominated by late-successional vegetation, but some areas lower in the watersheds have been harvested and contain relatively young successional stands. The Blue River watershed is primarily owned by the WNF, and also contains the HJ Andrews Experimental Forest, where the USFS, National Science Foundation, and Oregon State University have conducted collaborative long-term ecological research since the 1950s.

Nearly 4% of the watershed is classified as being suitable for cultivation, and almost the entire floodplain of the lower McKenzie watershed is privately owned, being used for agricultural or residential purposes (MWC 1996). The largest town in the McKenzie subbasin is the city of Springfield (population approximately 52,000) (PSU 1998). Many other small towns are scattered throughout the McKenzie valley, including the towns of Vida and McKenzie Bridge. The watershed is heavily used for recreation and is one of the most popular rivers for fishing and boating in Oregon (USACE 2000).

### *5.2.3 Safe Passage and Access to Historical Habitat*

The general relationship between safe passage/access to historical habitat and the biological requirements of UWR chinook salmon are described in Spence et al. (1996). Table 5-2 shows the properly functioning condition for safe passage and access to historical habitat in the McKenzie subbasin, status under the environmental baseline, and causes of the baseline condition, which are described in more detail below.

Table 5-2. Habitat requirements of UWR chinook salmon with respect to safe passage and access to historical habitat in the McKenzie subbasin, status under the environmental baseline, and causes of the baseline condition.

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Conditions Relative to Properly Functioning Condition | Cause of Baseline Condition |
|---|---|---|---|
| Safe passage and access | Safer passage and access to spawning, rearing, and migration habitat needed for the viability of a demographically independent population | *Trail Bridge and Smith Dams*<br>Trail Bridge and Smith dams exclude spring chinook salmon from a portion of their historical range<br>• EWEB annually maintains a spawning channel downstream of Trail Bridge Dam that does not appear to have fully mitigated for the loss of upstream habitat<br>• *Not properly functioning* | EWEB's Carmen-Smith Hydroelectric Project |
| | | *Leaburg-Walterville Project*<br>• Adult passage and delay, up to 14.5% mortality of outmigrating smolts, and low flows in the Leaburg and Walterville bypass reaches of the lower mainstem; to be corrected during 2002-2004 under terms of the new FERC licence | EWEB's Leaburg-Walterville Hydroelectric Project |
| | | *Predation as a barrier to migration*<br>• Isolated populations of bull trout in subbasin; all are small | |

<u>Barriers in the Upper McKenzie Subbasin</u>
Of the three dams that comprise EWEB's Carmen-Smith Project, Trail Bridge Dam cut off access to about 4 miles of historical spring chinook salmon spawning habitat and Smith Dam cut off about 3 miles. Carmen Dam is above a natural barrier to migration (Tamolich pool and falls).

When the Carmen-Smith Project was completed in 1963, a spawning channel was constructed downstream of Trail Bridge Dam to mitigate for blocking spring chinook salmon access to spawning and rearing habitat upstream of Trail Bridge Dam. A velocity barrier installed just upstream of the channel entrance prevents adult spring chinook salmon from entering the tailrace area of Trail Bridge powerhouse. The spawning channel was designed to accommodate between 100 and 200 spawners. While in most years the number of spawners using the channel has been below these levels, the most recent counts (in 2001 and 2002) documented at least 133 and 159, respectively, spawning chinook salmon returning to the channel. As discussed in section 4.2.1.6, the number of fish using the spawning channel tends to fluctuate with the size of the spawning runs into the upper McKenzie River.

In recent years, ODFW has released adult spring chinook salmon (surplus marked fish from the McKenzie River Hatchery) upstream of Trail Bridge Dam to spawn naturally and provide a forage base for resident bull trout. Some of the progeny of these spawners could have passed through the powerhouse and been subject to some unknown level of injury or mortality. However, the powerhouse intake tower is located about 160 feet out from the upstream face of the dam and the top of the intake opening is at a depth of about 60 feet at full pool. These features could minimize the entrainment of juvenile spring chinook salmon, although there are currently no data to estimate either entrainment or resulting mortality rates. The USFS' operated a screw trap below Trail Bridge powerhouse, and on 62 days during the period from late February through mid-July 1998, a test yielded 5 juvenile chinook salmon (1 dead at sampling), 1 juvenile cutthroat trout, 3 sculpins, and no bull trout (FERC 2003). Head injuries were noted on the dead juvenile chinook salmon (40 mm), but all other fish were alive with no external injuries.

<u>Other Barriers in the McKenzie Subbasin</u>
The USACE's Blue River Dam on the Blue River and Cougar Dam on the South Fork McKenzie River block UWR chinook salmon from historical spawning and rearing habitat. These barriers will not be discussed in detail because they are not within the action area.

<u>Predation as a Barrier to Migration</u>
There are two isolated populations of bull trout in the action area: in the mainstem McKenzie below Trail Bridge Dam, and above Trail Bridge Dam (ODFW 1997b). Both populations are small and there is no evidence that this natural predator limited the production of juvenile chinook salmon outmigrants.

### *5.2.4 Flow and Hydrology*

The general relationships between flow and hydrology and the habitat requirements of UWR chinook salmon and steelhead are described in Spence et al. (1996). Table 5-3 shows the properly functioning condition for flow and hydrology in the McKenzie subbasin, status under the environmental baseline, and causes of the baseline condition, which are described in more detail below.

Table 5-3. Habitat requirements of UWR chinook salmon with respect to flow and hydrolology in the McKenzie subbasin, status under the environmental baseline, and causes of the baseline condition.

| **Habitat Characteristic** | **Properly Functioning Condition** | **Description of Current (Baseline) Conditions Relative to Properly Functioning Condition** | **Cause of Baseline Condition** |
|---|---|---|---|
| Frequency of channel-forming and overbank flows | Flows that provide channel disturbance at a sufficient frequency to create and maintain channel complexity and important habitats for:<br>• juvenile rearing and hiding cover<br>• adult spawning (gravels)<br><br>Overbank flows that promote the exchange of nutrients, organic matter and sediment | Frequency of flows of sufficient magnitude to create and maintain channel complexity and provide nutrient, organic matter and sediment inputs from floodplain areas has been greatly reduced in the mainstem McKenzie rivers downstream from the South Fork McKenzie and Blue rivers.<br>• *not properly functioning* | Flood control operations at USACE's Cougar and Blue River dams reduce the magnitude and frequency of peak flows as far downstream as Vida |
| Rapid flow fluctuations | Gradual flow fluctuations that allow normal behavioral adjustments by anadromous fish. | • Flow fluctuates rapidly in the Smith River downstream of Smith Dam. Flow is re-regulated by Trail Bridge Dam, so no rapid fluctuations occur downstream of Trail Bridge Dam<br>• *properly functioning* | • Power peaking fluctuations cause rapid fluctuations downstream of EWEB's Smith Dam |

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Conditions Relative to Properly Functioning Condition | Cause of Baseline Condition |
|---|---|---|---|
| Seasonal flows | • Flows adequate to support the habitat needs of rearing, migrating, and spawning, salmonids<br>• Sufficient flow to avoid water temperatures that are too high for salmonids | • Spring and summer flow reductions have reduced juvenile rearing habitat area and increased the river's susceptibility to warming<br>• The upper McKenzie River just below Tamolich Falls may have insufficient flows<br>• Increased flows in the summer likely benefit rearing juveniles by increasing available habitat for rearing juveniles and by reducing water temperatures.<br>• Increased flows in the fall may encourage spring chinook salmon to spawn in areas that would subsequently become dewatered during active flood control operations.<br>• *not properly functioning* | • Late winter and spring refill operations at USACE's Cougar and Blue River reservoirs<br>• Summer diversions at EWEB's Leaburg-Walterville Project<br>• Diversion of water at Carmen Dam<br>• USACE flow augmentation operations at Cougar and Blue River reservoirs (typ. July - Aug.)<br>• USACE drafting operations to meet winter flood control pool levels at Cougar and Blue River reservoirs (Sept. - Nov.) |

Frequency of Channel-forming and Overbank Flows

Reductions in peak flows caused by flood control operations at Blue River and Cougar dams have contributed to the loss of habitat complexity in the mainstem McKenzie River by substantially reducing the magnitude of the channel-forming dominant discharge (i.e., the 1.5- to 2-year flood) and greatly extending the return intervals of larger floods. Over time, this has reduced channel complexity (e.g., the frequency of side channels and woody debris recruitment) and reduced the movement and recruitment of channel substrates. Side channels, backwaters, and instream woody debris accumulations have been shown to be important habitat features for rearing juvenile salmonids (section 5.6).

Before 1963, when work on the Cougar and Blue River projects began, the highest flow at Vida, Oregon, was 64,400 cfs, recorded in December 1945, and annual peak flows greater than 40,000 cfs were common. Since construction (1970), the magnitude of the two-year recurrence interval event has decreased from about 29,200 cfs to 17,500 cfs and no events have exceeded 35,000 cfs (Figure 5-1).

The operation of USACE's Blue River and Cougar dams is only partly responsible for the reduction in channel complexity noted in the mainstem McKenzie River. Bank stabilization measures and land leveling and development in the basin have directly reduced channel complexity and associated juvenile salmon rearing habitat. Changes in channel form in response to reductions in peak flows are probably highest in the unconfined portions of the channel, which extend from near Vida to the river's confluence with the Willamette River in Springfield, Oregon.

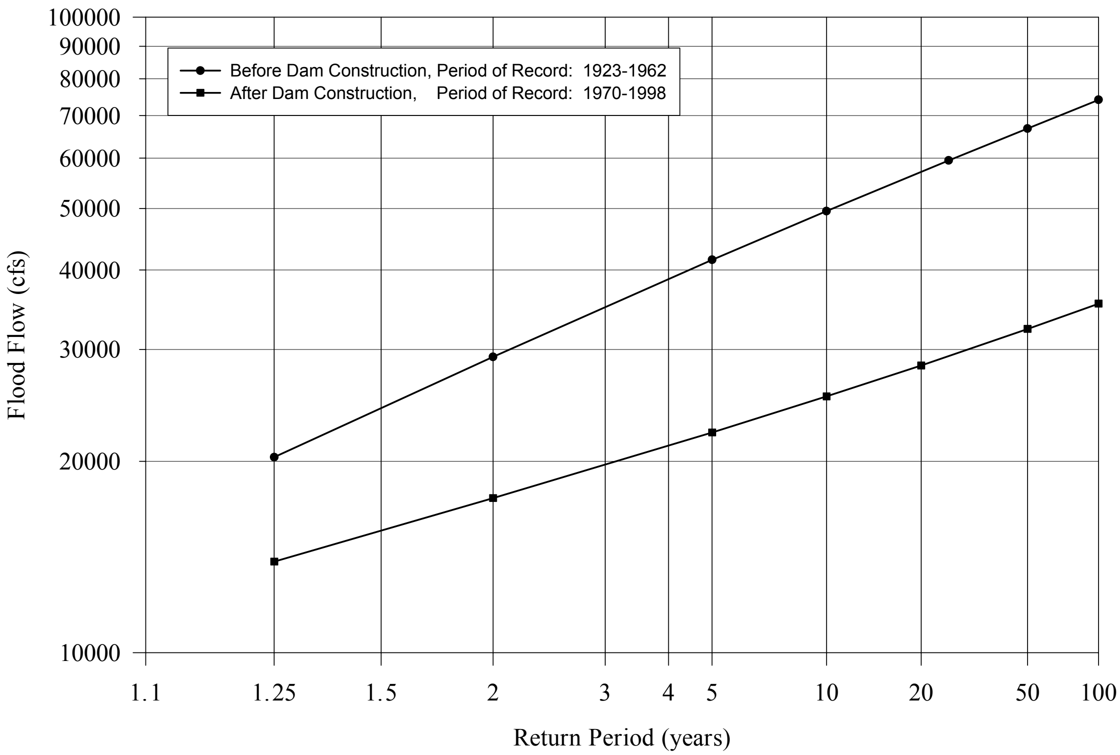


Figure 5-1. Flood frequencies at Vida on the McKenzie River (USGS gage 14162500 at RM 47.7) before and after the construction of Blue River and Cougar dams. The gage is 12 miles downstream of the South Fork McKenzie River's confluence with the mainstem McKenzie (from Fig. F-22 in USACE 2000).

Controlling peak flows prevents the flushing of fine sediments that accumulate on the river bed. Interstitial sediments finer than 1 mm can decrease the hydraulic conductivity of spawning gravels, reducing intragravel flow and the supply of oxygenated water to incubating eggs (Kondolf and Wilcock 1996). Somewhat coarser sediments (1 mm to 9 mm diameter) can fill interstices and physically block emergence of fry from the bed. Aquatic invertebrates also use open interstices in cobbles and gravel, and fine sediment can eliminate this habitat. The potential reduction in interstitial spaces may also affect juvenile salmonids, which are known to use interstitial spaces for cover during winter periods (Reiser 1998). Armoring (the process of increasing the dominant substrate particle sizes) also reduces the availability of suitable spawning substrates, and EA (1991) and Minear (1994) have documented channel armoring in the lower McKenzie River. These effects in the McKenzie River persist unabated through most of the river downstream from Blue River, Oregon, because there are no sizable tributaries that could replenish flows, sediment, and large wood. Effects are exacerbated by storage of sediment and large wood in the Leaburg Dam pool.

Controlling peak flows can reduce the potential for scouring spring chinook salmon redds during high flow events.

<u>Flow Fluctuations</u>
Flow fluctuates in the Smith River downstream of Smith Dam. However, flows are re-regulated by Trail Bridge Dam, so no rapid fluctuations occur in the mainstem McKenzie River downstream of Trail Bridge Dam.

<u>Seasonal Flows</u>
Investigations into changes in streamflow patterns following the construction of the Carmen-Smith Project have been conducted by the Willamette National Forest (WNF MRD 1995). Statistical comparisons of streamflow patterns between the Clear Lake outlet USGS gage station and the McKenzie Bridge gage station for the period 1948-1993 did not indicate a shift in stream flows, indicating that annual maximum mean flows have not changed as a result of the construction and operation of the Carmen-Smith Project. Similar tests performed by the USFS on mean annual minimum flows show that since the construction of the Carmen-Smith Project, summer low flows in the McKenzie River at McKenzie Bridge are slightly higher. Conflicting information from separate statistical analyses performed by the USFS indicates that summer flows have decreased since the construction of the Carmen-Smith Project. If the operation of the project does not result in long-term storage of water, then the changes in summer flows at the McKenzie Bridge gage described by the USFS are attributable to many possibilities, including: 1) changes in underground reservoir storage due to tunneling during construction of the Carmen-Smith Project , 2) changes in runoff patterns resulting from timber harvest practices in the upper watershed, 3) long-term shifts in water availability and transport in underground reservoirs of the upper watershed, or 4) some combination of the above.

Because the Carmen-Smith Project is operated as a run-of-river project, and Trail Bridge Dam functions as a re-regulating facility, the project has probably not significantly affected flows in the mainstem McKenzie River downstream of Trail Bridge Dam. However, flows within the Carmen-Smith Project have been altered significantly over historic conditions. The 25-foot tall Carmen Dam and 30-acre reservoir divert most of the water from the upper McKenzie and Icecap Spring underground 2 miles via an unscreened tunnel to the Smith River watershed (FERC 2003), where it empties into Smith Reservoir. According to historical information, downstream from Carmen Dam, the McKenzie River used to flow underground, reemerging below Tamolich Falls, the first major fish barrier progressing upstream from its confluence with the Willamette River. Most information suggests that the immediate reach above Tamolich Falls was dry except under high flow conditions. Despite the diversion of the entire McKenzie River at Carmen Dam, water still emerges below Tamolich Falls and flows approximately 2 miles before reaching Trail Bridge Reservoir. There have been no studies to quantify the change in flow in the McKenzie River reach below Tamolich Falls as a result of the Carmen Diversion.

The hydrology of the mainstem McKenzie River is strongly driven by groundwater inputs and prior to dam construction, tended to display relatively constant flows (Figure 5-2). Vast areas of porous lava in the upper watershed retard surface runoff and act as a natural reservoir for large, constant-flowing springs. Winter (December through February) monthly mean flows at Vida, Oregon, were only about 2½ times as high as in late summer (August and September). The majority of runoff occurs during winter, and flows are lowest during July, August, and September. The combined operation of Blue River and Cougar dams has reduced average daily April flows in the mainstem McKenzie River at Vida by 21% and has increased average daily August flows by 145% (Figure 5-2).

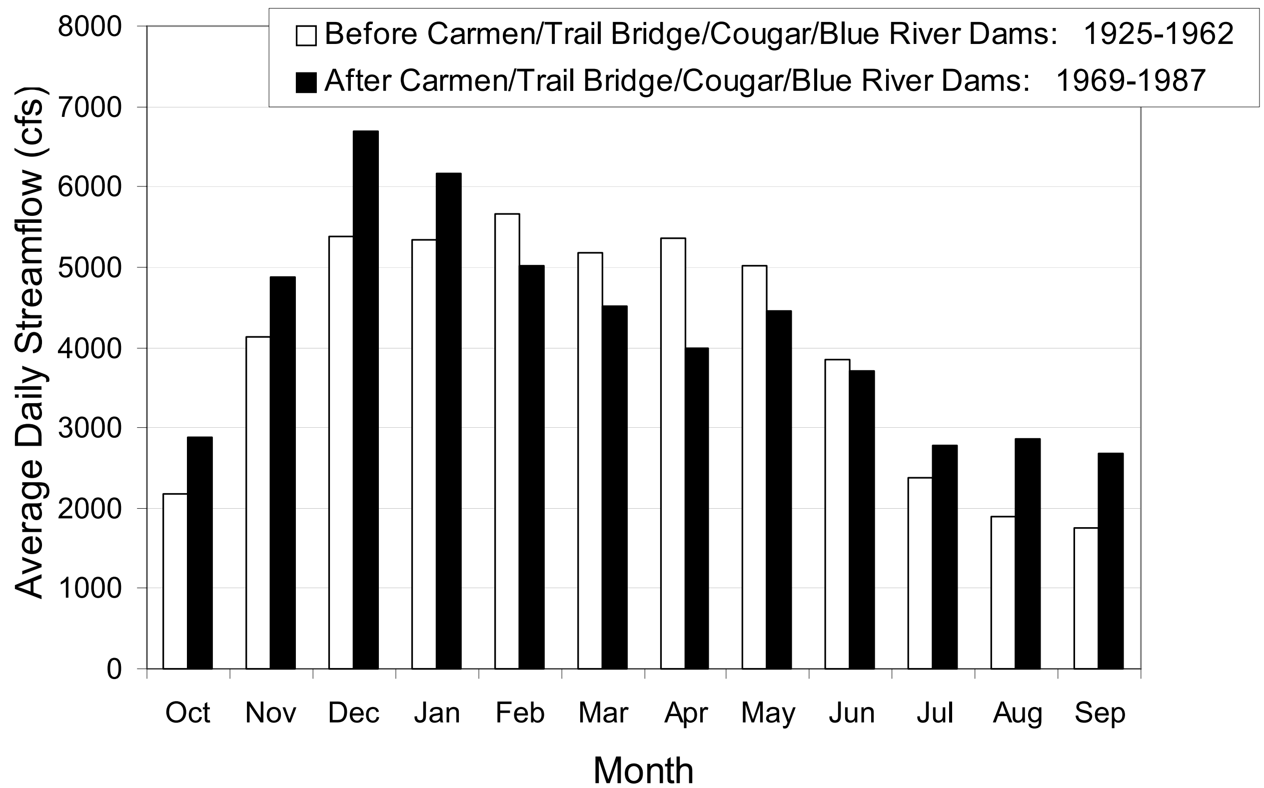


Figure 5-2. Monthly average flows at Vida on the McKenzie River (USGS gage 14162500 at RM 47.7) before and after the construction of Blue River, Cougar, and other dams. The gage is 12 miles downstream of the South Fork McKenzie River's confluence with the mainstem McKenzie (from Fig. F-58 in USACE 2000).

In the mainstem McKenzie River at Vida, Oregon, (USGS Station No. 14162500) the lowest flow ever recorded was 1,260 cfs, which occurred several times during September, October, and November in 1930 and 1931. Following dam construction, the lowest flows observed at the Vida gage were 1,330-cfs readings observed in February 1977 and October 1992. Flows between the Leaburg Diversion Dam and the river's confluence with the Leaburg powerhouse tailrace (5.8 miles) and between the Walterville diversion and the river's confluence with the Walterville powerhouse tailrace (7.3 miles) are expected to be 1,000 cfs over half of the time in July, August, September, and October under the project's new license (FERC 1996).

The McKenzie River has been extensively developed to supply water for agricultural, municipal, and industrial land uses. The Oregon Water Resources Department (OWRD) has issued permits for surface water withdrawals totaling 11,994 cfs from the McKenzie River. This is a maximum allowable diversion right, and actual diversions are much lower at any particular time. Almost all of the water diverted for hydropower use and roughly half the water diverted for other uses returns to the river downstream from the point of diversion. Flows in the river reaches between the point of diversion (e.g., the Leaburg and Walterville canals) and the point of return (e.g., Leaburg and Walterville powerhouse tailraces) may be substantially reduced.

The OWRD water availability process (OAR 690-400-011) has determined that natural flow is available for out-of-stream use in all months from the McKenzie River at the confluence with the Willamette River (OWRD 2003). However, the Willamette Basin Program Classifications (OAR 690-502-0110) require that new surface water users in the subbasin obtain water service contracts from the U.S. Bureau of Reclamation (USBR) (i.e., for use of water stored in Willamette Project reservoirs) for uses that would include the summer months (e.g., irrigation). The USBR has issued contracts for 2,373 acre-feet of water from Cougar and Blue River reservoirs (Eggers 2002).

The largest diversions from the McKenzie River are associated with hydropower developments. At RM 35, Leaburg Dam diverts up to 2,500 cfs into the Leaburg Canal, which reduces flows in about 5.8 miles of the McKenzie River. Flows in the reach between the diversion and the powerhouse tailrace may be reduced to 1,000 cfs in accordance with the project's hydropower license (FERC 1996). At about RM 25, up to 2,577 cfs is diverted into the Walterville Canal, which reduces flows in about 7.3 miles of the McKenzie River. Flows in the intervening river reach may also be reduced to 1,000 cfs. Flows approaching these minima are most likely to occur during July, August, September, and October. The river also provides domestic water supplies to the city of Eugene, Oregon, through a diversion located at Hayden Bridge (maximum withdrawal rate of 300 cfs).

To prevent substantial adverse effects on migrating adult or rearing juvenile UWR spring chinook salmon, the FERC license issued for the Leaburg-Walterville Project requires that EWEB maintain flows of 1,000 cfs in the 5.8-mile river reach bypassed by the Leaburg project and the 7.3-mile river reach bypassed by the Walterville project. Reducing flows to 1,000 cfs increases the river's response to summer heat. EWEB estimated that by reducing flows to 1,000 cfs in the McKenzie River's bypassed reaches, the Leaburg-Walterville Project increased August water temperatures by about 0.7 °C (EWEB 1995 *in* FERC 1996). Water temperature effects are discussed in Section 5.2.7.

The effects of reducing late winter and spring flows on spring chinook salmon are unknown. Of concern is the difference between flows in late summer and early fall, when spring chinook salmon select spawning sites and the reservoirs are being drafted for flow augmentation and flood control, and the minimum flows discharged during active flood control operations in the winter. This difference can result in redds established in the late summer and fall being dewatered during the winter, prior to emergence. Depending on the duration and rate of dessication, dewatering salmon redds can kill incubating eggs and alevins (Reiser and White 1983). It can also cause entrapment and stranding of juvenile salmonids. It is possible that these effects occur in the mainstem McKenzie River.

<u>Summary</u>
Human-caused alterations of the hydrologic regimes of the lower McKenzie River and its principal tributaries have generally diminished flow-related habitat quantity and quality and have probably reduced the numbers, productivity, and life history diversity (adult run timing and juvenile outmigrant strategies) of spring chinook salmon and limited the production potential of habitat in the action area.

### *5.2.5 Riparian Vegetation and Floodplain Function*

Table 5-4 shows the properly functioning condition for riparian vegetation and floodplain function in the McKenzie subbasin, status under the environmental baseline, and causes of the baseline condition, which are described in more detail below.

Table 5-4. Habitat requirements of UWR chinook salmon with respect to riparian vegetation and floodplain function in the McKenzie subbasin, status under the environmental baseline, and causes of the baseline condition.

| Habitat Characteristic | Properly Functioning Condition | Current (Baseline) Conditions Relative to Properly Functioning Condition | Cause of Baseline Condition |
|---|---|---|---|
| Headwater riparian forest extent and composition | Headwater riparian forest extent and composition that provide sufficient shading, large wood recruitment, leaf litter, nutrient filtration and input, and bank stability to create and maintain aquatic habitat<br><br>• Includes primarily mature coniferous riparian forests, with occasional patches of young seral forest created by upland or fluvial disturbance<br><br>• Includes primarily mature coniferous riparian forests, with occasional patches of young seral forest created by upland or fluvial disturbance | Riparian areas in some tributaries contain mature riparian vegetation, but some are dominated by deciduous trees or conifers<br>• Some tributaries do not provide adequate shading or large wood recruitment<br>• decreased extent of streamside riparian vegetation<br><br>• *Not properly functioning* | • Timber harvesting<br>• Stream clean-out practices<br>• Inundation of streamside riparian vegetation by USACE and EWEB reservoir construction |

| Habitat Characteristic | Properly Functioning Condition | Current (Baseline) Conditions Relative to Properly Functioning Condition | Cause of Baseline Condition |
|---|---|---|---|
| Floodplain forest extent and composition | Floodplain forest extent and composition that support sufficient shading, large wood recruitment, and nutrient inputs to create and maintain aquatic habitat<br><br>• Primarily deciduous vegetation (ash, cottonwood, maple) in a variety of successional stages across the floodplain | • Many remaining patches of floodplain forest are interspersed with pastureland, highways, and residential development<br>• The percentage of mature riparian forest downstream of Trail Bridge Dam has decreased significantly<br>• Extent of floodplain vegetation restricted to a narrow band along river<br>• Low large wood recruitment potential<br><br>• *Not properly functioning* | • Clearing for agriculture or development<br>• EWEB constructed transmission lines for the Carmen-Smith Project in the riparian area.<br>• USACE and private revetments<br>• USACE operation of Cougar and Blue River Dams alters the hydrologic regime<br>• Timber harvest |
| Floodplain connectivity | Floodplain connectivity (overbank flow) that supports nutrient exchange, organic and inorganic matter exchange, sediment erosion and deposition, large wood recruitment, and refugia for fish<br><br>• Frequent floodplain innundation and off-channel connectivity during high flow events in fall, winter, and spring | • Floodplain in the mainstem McKenzie downstream of the confluence with the South Fork is not frequently inundated, with less overbank flow and side channel connectivity<br>• Reduced nutrient exchange, reduced sediment exchange, reduced flood refugia for fish, and reduced establishment of new riparian forests<br><br>• *Not properly functioning* | • USACE operates Cougar and Blue River Dams to reduce the magnitude and frequency of peak flows<br>• USACE and private revetments<br>• Residential development |

The majority of riparian forests in tributaries to the upper McKenzie River (including those above Trail Bridge Dam) include a high percentage of old growth habitat (ranging from 45% to 59%), with a small portion of early successional riparian forest (4% to 21%) (WNF BRRD 1995). Along the mainstem McKenzie River, riparian areas upstream of Hendricks Bridge are dominated by conifers whereas those downstream are dominated by hardwoods. Two recent studies have assessed change in riparian cover along the mainstem McKenzie using aerial photographs. Minear (1994) compared 1949 to 1986 aerial photographs, both series taken upstream of Leaburg Dam, while MWC (2000) compared 1944 to 2000 photographs taken farther downstream. The percentage of mature conifers in riparian areas in the reach between Trailbridge Dam and Belknap Springs decreased from 62% to 39% between 1949 and 1986, with a corresponding increase in young conifers, hardwoods, and riparian roads, including Highway 126 (Minear 1994). Minear (1994) reports that transmission lines constructed for the Carmen-Smith Project contributed to the decline in mature riparian conifers below Trail Bridge Dam. Between Belknap Springs and Rainbow Bridge, riparian vegetation changed little from 1949, with approximately 12% to 27% consisting of mature conifers, 60% to 67% consisting of 20- to 100- year-old conifers, and a small percentage of young conifers and hardwoods. Between Rainbow Bridge and the confluence with the South Fork, where the floodplain is wide and dynamic, riparian vegetation was described during the 1937 survey as "thick, almost impenetrable," consisting of conifers, alder, willow, maple, and brush (Minear 1994). The percentage of mature conifers in this area declined from 53% to 17% by 1986, while the percentage of second-growth conifers increased. Below the confluence with the South Fork McKenzie, the valley is very wide, and much of the riparian vegetation (including that on islands) was logged in the late 1950s (Minear 1994). However, the riparian areas resemble those in 1949, with approximately 60% in 20- to 100-year-old coniferous forest and approximately 16% in deciduous forest.

Between Trail Bridge Dam and Leaburg Dam, approximately 5.2% of the riparian area is covered by paved roads, and 6% has been developed for residential or commercial purposes (Minear 1994). MWC (2000) documented 466 riverfront homes between Finn Rock and the I-5 Bridge, 85% of which were associated with disturbed riparian vegetation, most likely for maintenance of a river view. Below Hendricks Bridge, young hardwood trees between 15 and 39 years old are common within 500 feet of the river throughout most of the McKenzie, but hardwoods greater than 40 years old are scarce (MWC 2000). MWC (2000) suggests that the flood of 1964 cleared much of the vegetation near the river, and that present-day stands are those which established on open surfaces created by the flood. Willows and other hardwood are found downstream of Hayden Bridge, and are more common than in 1944, as reduced peak flows have probably enabled willows to colonize gravel bars that historically would be inundated or reshaped by high flows (MWC 2000).

In addition, over 11 miles of riparian vegetation in the lower McKenzie River has been replaced by riprap revetments installed by the USACE (USACE 2000). Residential, recreational, and commercial development along Highway 126 has decreased quantity and quality of riparian forests along the north bank of the McKenzie River (MWC 1996), and over 92% of the streamside forests along the McKenzie have been altered (Gregory et al. 1992). Historically, the riparian forest along the lower McKenzie was between 1,000 feet and 4,000 feet wide, but is now confined to a narrow band next to the river (MWC 2000). The majority of large conifers are located above McKenzie Bridge, and overall conifer presence has decreased 44% from 1949 levels (Minear 1994). Peak flows necessary to form and maintain gravel bars for vegetation colonization have decreased, exacerbating the loss of riparian forest caused by timber harvesting, encroachment of agriculture and residential development, and replacement by revetments and roads (section 5.2.4). The lack of peak flows has also decreased the frequency at which the floodplains are inundated, which decreases nutrient, organic matter, and sediment exchange between the floodplain and the river, and does not allow juvenile salmon to access to floodplain refugia in high-water events.

In summary, riparian forests downstream of Trail Bridge Dam are not capable of performing all of the valuable functions associated with properly functioning riparian forests. Highway 126 and associated commercial and residential development directly displace riparian forests and inhibit establishment of new vegetation. Reaches lacking adequate riparian vegetation probably cannot adequately filter agricultural chemicals, nor provide adequate large wood to create significant aquatic habitat. The reducing inundation of the McKenzie floodplain decreases nutrient, organic matter, and sediment exchange and does not allow juvenile salmonids access to high-water refugia on floodplains. A continued lack of large wood in large rivers can reduce gravel bar and side channel formation, a process which is already declining in the lower McKenzie River (section 5.2.6).

### *5.2.6 Large Wood, Sediment Transport, and Channel Complexity*

The general relationships between large wood, sediment transport, and channel complexity and the biological requirements of UWR chinook salmon and steelhead are described in Spence et al. (1996). Large wood and sediment transport processes within the action area depend on these processes in tributaries that enter the McKenzie River downstream of Trail Bridge Dam. Thus, in this section, NOAA Fisheries discusses large wood and sediment processes in the tributaries of the McKenzie River in order to determine the relative effects the proposed action may have on these processes. Table 5-5 shows the properly functioning condition for large wood, sediment transport, and channel complexity in the McKenzie subbasin, status under the environmental baseline, and causes of the baseline condition, which are described in more detail below.

Table 5-5. Habitat requirements of UWR chinook salmon with respect to large wood, sediment transport, and channel complexity in the McKenzie subbasin, status under the environmental baseline, and causes of the baseline condition.

| Habitat Characteristic | Properly Functioning Condition | Current (Baseline) Conditions Relative to Properly Functioning Condition | Cause of Baseline Condition |
|---|---|---|---|
| Large wood in headwater tributaries | Large wood (frequency and composition) in tributaries that retains sediment, creates hydraulic complexity, provides cover and habitat for invertebrates and anadromous salmonids : ODFW benchmarks for small streams:<br>• > 20 pieces per 100m (greater than 15 cm diameter and 3 m long)<br>• >3 key pieces per 100m (greater than 60 cm diameter and 10 m long)<br>• USFS targets >80 or 150 pieces (> 24 in diameter) per /mile in most McKenzie tributaries | • Large wood does not meet USFS targets in some tributaries (Lower Deer Creek, Quartz Creek, Mohawk River, the South Fork and some of its tributaries)<br>• Large wood meets USFS targets in some tributaries. Horse Creek has a high recruitment potential<br>• Some restoration efforts are underway in the upper McKenzie subbasin<br>• *Not properly functioning* | • Timber harvesting<br>• Stream clean-out<br>• Fire suppression |

| **Habitat Characteristic** | **Properly Functioning Condition** | **Current (Baseline) Conditions Relative to Properly Functioning Condition** | **Cause of Baseline Condition** |
|---|---|---|---|
| Large wood in mainstem McKenzie | Large wood (of sufficient frequency and composition) in the mainstem that retains sediment, creates hydraulic complexity, facilitates spawning gravel deposition and provides cover and habitat for invertebrates and anadromous salmonids<br>• Contains large wood accumulations along channel margins, and on bars or in channels within low-gradient reaches (specific benchmarks have not been developed) | • The upper McKenzie River below EWEB's Trail Bridge Dam is deprived of large wood, although some restoration efforts have begun, some areas below Smith Dam may lack large wood<br>• Operations at Cougar and Blue River dams capture large wood from their respective headwaters and remove it from the system.<br>• Inadequate recruitment of large wood from riparian areas along mainstem McKenzie and tributaries downstream from Cougar and Blue River dams<br>• Lack of large wood-associated habitat for anadromous salmonids and invertebrates upon which they feed<br>• The upper McKenzie River below Trail Bridge Dam is deprived of large wood<br><br>• *Not properly functioning* | • USACE removes large wood from Cougar and Blue River reservoirs<br>• EWEB removes large wood from Carmen-Smith Project reservoirs<br>• USACE removed snags in lower river for navigation<br>• Inadequate recruitment from riparian forests<br>• Removal of large wood by landowners and boaters for navigation and/or firewood |

| Habitat Characteristic | Properly Functioning Condition | Current (Baseline) Conditions Relative to Properly Functioning Condition | Cause of Baseline Condition |
|---|---|---|---|
| Sediment transport and deposition processes | Sediment transport and deposition processes that provide the bed material needed to create side channels, resting pools, bed complexity, and spawning gravel<br><br>• Sediment budget balanced by transport from upstream reaches, recruitment from floodplain, and deposition in alluvial reaches<br><br>• Large quantities of spawning gravel interspersed with bedrock and cobble reaches | • Trail Bridge and Smith reservoirs trap sediment from the Upper McKenzie and Smith watersheds, and substrate may have coarsened downstream of Trail Bridge Dam<br>• Substrate has coarsened in the mainstem McKenzie downstream of the South Fork and Blue rivers<br>• Mainstem channel downstream of USACE dams could lack spawning gravel<br>• Current sediment budget not creating and maintaining mainstem habitat needed by anadromous salmonids<br><br>• *Not properly functioning* | • USACE and EWEB reservoirs trap sediment and large wood from headwaters<br>• USACE operates Cougar and Blue River dams to reduce the magnitude and frequency of peak flows<br>• USACE and private revetments<br>• gravel mining |
| Channel complexity | Channel complexity that provides hydraulic variation, hyporheic connectivity, and habitat need by rearing, holding, and spawning anadromous salmonids<br>• Side channels and alcoves present in alluvial reaches, frequent erosion and creation of channel features | • Side channel habitat has decreased downstream of Trail Bridge Dam<br>• The mainstem McKenzie below the Deerhorn Park lost 53% of its islands, and many side channels have filled in and become alcoves<br>• The McKenzie prior to dam construction migrated frequently, and has since stabilized<br>• The lower McKenzie is simplified and channelized<br><br>• *Not properly functioning* | • EWEB's Carmen-Smith Project traps sediment and large wood from 15% of the McKenzie subbasin<br>• USACE operates Cougar and Blue River dams to reduce the magnitude and frequency of peak flows<br>• USACE and private revetments<br>• USACE and EWEB remove large wood from reservoirs<br>• gravel mining in lower river |

While the Deer, Bunchgrass, and Smith drainages historically produced large quantities of sediment and large wood, road building and timber harvest have reduced the size of particles entering the streams and reduced the recruitment of large wood. Lower Deer Creek lacks large wood and pool habitat, but restoration efforts by WNF in the late 1980s attempted to form pools by placing large wood and boulders in the streams, and form side by installing deflectors that direct flow into side channels. All of the sediment and large wood discharged from the Smith River, Bunchgrass Creek, and other upper tributaries is captured in Carmen, Smith, or Trail Bridge reservoirs, depriving the McKenzie River below Trail Bridge Dam of large wood and sediment. Exacerbating this effect, large wood was removed from the mainstem McKenzie between Trail Bridge Dam and Belknap Springs after the 1964 and 1972 floods in a misguided effort to improve aquatic habitat, and continues to be removed by recreational boaters and rafters (WNF MRD 1995). Side channel length has decreased by 34% to 669 m/km, but in the larger reach from Trail Bridge Dam to McKenzie Bridge, channel area and sinuosity did not change significantly over the same period (Minear 1994; Sedell et al 1992). Sedell et al. (1992) found a 41% reduction in the frequency of large pools in the reach from Smith River Bridge to Belknap Hot Springs, but observed an increase of 21% in large pool frequency between Belknap Springs and McKenzie Bridge. Sedell et al. (1992) also observed a general coarsening of substrate type in the upper segments of the McKenzie River downstream of Trail Bridge Dam. In an inventory conducted in 1999 for the USFS, Siskiyou Research Group (1999) counted 33 side channels in the segment of river between Trail Bridge Dam and Dearborn Island. Given the different time periods and coverage areas for each study, these studies cannot be directly compared. The river becomes constricted by Highway 126 and confined by riprap as it nears the town of McKenzie Bridge.

Below McKenzie Bridge, the McKenzie valley floor widens and the confluence of Horse Creek and the McKenzie River forms a dynamic delta with high potential for channel movement and side channel development (Minear 1994). Between Rainbow Bridge and Finn Rock, the valley has a gradual slope, well-developed floodplain, and encompasses the confluence of the South Fork McKenzie River. Over the last decade, the channel in this reach has straightened, abandoned former side channels, and lost pool habitat (Minear 1994). Many of these changes could be associated with changes in the South Fork McKenzie River due to the construction of Cougar Dam and reservoir and land management in the South Fork drainage.

Upper Horse Creek is relatively steep and dominated by cobble and boulders. An extensive alluvial fan and broad floodplain has formed in Horse Creek just above its confluence with the McKenzie River. The alluvial fan changed dramatically in the 1964 flood, when sediment from debris flows in the upper watershed settled out and created new channels. However, following the 1964 flood, the WNF and ODFW removed large wood and installed riprap in this reach and throughout the Horse Creek drainage. The 1996 flood and stream restoration activities in the early 1990s have restored some of the large wood in the drainage, and the relatively undisturbed, mature riparian areas in the Horse Creek drainage are capable of recruiting large wood (WNF MRD 1997). Additionally, the fire program for the basin enables managers to allow some lightning-ignited fires to burn, which could contribute sediment and large wood. While the Horse Creek drainage has landforms prone to instability, the watershed is not dominated by these features. However, the basin experienced road-associated slope failures during the flood of 1996, and many drainages show a history of natural debris flows (WNF MRD 1997). Additionally, Horse Creek is one of the largest undammed tributaries on the McKenzie River, and plays a vital role in supplying sediment and large wood to the McKenzie River.

The lower South Fork McKenzie (below Cougar Dam) lacks large wood and has very low large wood recruitment potential (WNF BRRD 1994). In this reach, the area of exposed gravel and cobble bars decreased by 43% following the 1964 flood, and the channel has downcut and become armored (WNF BRRD 1994). Riparian vegetation is now colonizing gravel bars along the South Fork below Cougar Dam. These gravel bars are associated with secondary channels that, before project construction, were frequently inundated and reworked by the river during high-flow events (WNF BRRD 1994). All of the large wood and sediment from the Blue River system is retained within Blue River Reservoir, located 1.7 miles upstream from the confluence of Blue River and the McKenzie River.

EWEB's Carmen-Smith-Trail Bridge complex in the upper McKenzie, and to a greater extent, Cougar Dam on the South Fork McKenzie and Blue River Dam on the Blue River, intercept large wood and sediment from much of the McKenzie's headwaters. Additionally, it was common practice for landowners and recreational boaters to remove large wood from the channel for flood control, navigation purposes, or to sell marketable wood (Minear 1994). Quartz Creek and the Mohawk River are two major undammed tributaries of the McKenzie downstream from Blue River which could supply large wood and sediment to the depleted reaches. However, both have relatively low levels of large wood and low large wood recruitment potential (MWC 2000; BLME 1995). The Mohawk River was cleared of large wood and boulders to allow log drives, and splash damming[5] removed additional wood, while scouring the stream down to bedrock. Large wood recruitment potential is low, and gravel is not retained in the system. (BLME 1995). None of the reaches of smaller tributaries of the lower McKenzie River have adequate large wood, and an estimated 58% of the riparian stands along these tributaries have inadequate near-term large wood recruitment potential (Weyerhaeuser 1994).

In addition to trapping large wood from 35% of the McKenzie watershed, the dams also retain sediment and significantly alter flow regimes within the McKenzie River as described in section 5.2.4. Before dam construction, the 5-year recurrence interval flow (measured at the Vida gage) was over 40,000 cfs, large enough to move sediment up to 150 mm in diameter (the estimated pre-project median particle size) (Minear 1994). After dam construction, the 5-year return interval flow was reduced to about 22,000 cfs, which is not capable of mobilizing particles 150

[5]Timber harvesters created small "splash" dams to form temporary ponds for log storage. They would explode the dam, sending the mass of water and logs downstream, which often removed all existing large wood in a stream and frequently scoured streams down to bedrock.

mm in diameter. Minear (1994) found that the percent of substrate particles larger than 150 mm increased from 56% during 1937 through 1938, to 75% in 1991, suggesting substrate coarsening.

As a result of flood control operations and a lack of large wood and sediment from tributary sources, the mainstem McKenzie River downstream of the Blue River and South Fork confluences has changed significantly since early surveys in the 1930s and the aerial photographs of the 1940s. EA (1991) concluded that significant channel change occurred in the McKenzie River between 1910 and 1950 when the river was very active (prior to construction of the flood control reservoirs and revetments). However, between 1930 and 1990, the river lost 53% of islands, 51% of island area, and 59% of island perimeter habitat in the reach between Deerhorn Park and the confluence with the Willamette River. Between Hendricks Bridge and Hayden Bridge, side channels are much less abundant than in 1944, while alcoves have increased (MWC 2000). MWC (2000) suggests that dampened peak flows has caused the upper ends of side channels to fill in with sediment, creating an increase in alcoves. Alcoves and side channels are scarce downstream of the I-5 Bridge due to extensive channelization for gravel extraction and the

City of Springfield. Sedell et al. (1991) report that the number of large pools in the lower McKenzie below Leaburg Dam decreased by 67% between 1938 and 1991.

In summary, a lack of large wood and sediment, reduced peak flows, loss of riparian vegetation, and installation of revetments have contributed to simplification of the mainstem McKenzie River. In the relatively confined reach below Trail Bridge Dam, the McKenzie has lost side channel habitat and large wood, and in the unconfined reach between Belknap Springs and Finn Rock has become less sinuous and lost pool habitat. In the lower, unconfined reaches, the river has lost considerable islands and side channels. Lack of sinuosity, side channel habitat, large pools, and large wood accumulations decrease the hydraulic complexity of the river channel, which prevents formation of localized areas of reduced velocity where smaller particles settle out, and where juvenile salmonids can rear. Hardin-Davis et al. (1990) state that side channel habitat is one of the three most frequently-used habitat types for larger juvenile chinook salmon, and suggest that side channel habitat is even more important for smaller juveniles and fry, due to the slower velocities and increased edge habitat they provide. Juvenile salmonids prefer to hold near velocity margins where velocity adjacent to the fish is slightly higher, presumably so they can maintain their position in lower velocities, while feeding on insects that pass by in the adjacent higher velocity (Hardin-Davis et al. 1990). A reduction in juvenile rearing habitat could reduce production of spring chinook salmon in the McKenzie subbasin.

The channel of the McKenzie River appears to have coarsened downstream of the EWEB and USACE projects, which could impact the availability of spawning gravel in the McKenzie River. Ligon et al. (1995) observed that an average of 8.5 female chinook salmon were counted per redd in a reach of the McKenzie River above Leaburg Dam between1970 and 1986. The authors stated that it is likely that spawning gravel limitations were resulting in redd superimposition.

However, the female/redd estimate was derived from Leaburg counts and aerial redd counts (assuming a 1:1 sex ratio) and aerial counts in the upper McKenzie River basin have been shown to significantly under-count the number of redds based on a comparison with ODFW ground surveys (Grimes et al. 1996; Lindsay et al. 1997). This is thought to be due to the narrowing of the channel, overhanging vegetation, and the propensity for chinook salmon to spawn along the margins, which inhibits the view from the air. As a result, aerial counts in the upper McKenzie basin, which could overinflate estimates of females/redd, were discontinued after 1997 (FERC 2003). Further, USACE (2000) reports that only 1% of the available spawning gravel in the mainstem McKenzie River is used by chinook salmon. Thus, evidence regarding the adequacy of spawning gravel quantity and quality available to spring chinook salmon in the mainstem McKenzie River is inconclusive at this time.

### *5.2.7 Water Quality*

The general relationships between water quality and the biological requirements of UWR chinook salmon are described in Spence et al. (1996). Table 5-6 shows the properly functioning

condition for water quality in the McKenzie subbasin, status under the environmental baseline, and causes of the baseline condition, which are described in more detail below.

Table 5-6. Habitat requirements of UWR chinook salmon with respect to water quality in the McKenzie subbasin, status under the environmental baseline, and causes of the baseline condition.

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Condition Relative to Properly Functioning Condition | Cause of Baseline Condition |
|---|---|---|---|
| Water temperatures | Water temperatures that support all life-history phases occupying the action area<br>• Maximum temperatures (7 DADM[1]) that do not exceed EPA recommendations for summer maximum temperatures for spawning, incubation, fry emergence, core and non-core rearing, adult and juvenile migration, and steelhead smoltification<br><br>• Minimum temperatures that do not fall below 52°F (11°C) during adult chinook salmon and steelhead migrations | • Cooler water temperatures in the mainstem McKenzie in the late spring and summer probably impeded upstream migration of spring chinook salmon; warmer fall/winter temperatures accelerated egg incubation and fry emergence<br><br>• EWEB's Leaburg-Walterville Project diverts flow into two power canals downstream of RM 38; water at lower ends of the two mainstem bypass reaches could increase by 2.7 and 3.6°F, respectively, due to diversions<br><br>• ODEQ database indicates that temperatures in the mainstem McKenzie from RM 0 to 54.5 have exceeded the recommended maximum for spawning, incubation, and emergence | • USACE projects (Cougar and Blue River)<br><br>• EWEB (Leaburg-Walterville)<br><br>• USACE projects (Cougar and Blue River)<br><br>• EWEB's Leaburg and Walterville diversions |
| • Dissolved oxygen | • Dissolved oxygen levels that support all life-history phases occupying the action area (App A)<br><br>• 7 DADM = 11 mg/L for spawning and incubation[2]; absolute minimum of 8 mg/L for passage and rearing[3] | • ODEQ 2002 CWA 303(d) database indicates that the Mohawk River (RM 1.5) was water quality limited for dissolved oxygen from October 1 through May 31<br><br>• *Not properly functioning* | • unknown |

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Condition Relative to Properly Functioning Condition | Cause of Baseline Condition |
|---|---|---|---|
| Total dissolved gas | TDG levels that support all life-history phases occupying the action area (App A)<br>• TDG not exceeding 120% of saturation in the tailrace where the water is deeper than 13 feet[4]<br>• TDG not exceeding 105% of saturation at the redd level when yolk sac larvae are present | • *Properly functioning* | |
| Nutrients | Nutrient levels that support all life-history phases occupying the action area (App A)<br>• No excess nutrients from agricultural, industrial, or other sources<br>• Adequate supply of marine derived nutrients to habitat in the upper watershed | • ODEQ 2002 CWA 303(d) database does not indicate that any streams in the McKenzie subbasin are water quality limited due to excess nutrients<br>• Supply of natural marine-derived nutrients to McKenzie headwaters and the Smith River had ceased, but in recent years, ODFW has released hatchery adults to provide the missing carcasses<br>• *Not properly functioning* | • USACE project<br>• EWEB's Carmen-Smith Project (no passage at Trail Bridge Dam) |

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Condition Relative to Properly Functioning Condition | Cause of Baseline Condition |
|---|---|---|---|
| Turbidity | Turbidity levels that support all life-history phases occupying the action area (App A)<br>• Low turbidity | • Release of turbid water during the spring 2002 drawdown of Cougar Reservoir for construction of the water temperature control tower resulted in elevated turbidity levels, including a maximum of 379 NTU (compared to background of 5 NTU)<br>• After the turbidity event, higher proportions of fine sediments in gravel bars below Cougar Dam compared to reaches above the reservoir; clay enrichment decreased rapidly downstream; clouds of sediment stirred up while wading in the South Fork below Cougar Dam, and to some extent in the mainstem McKenzie<br>• *Not properly functioning* | USACE project (Cougar WTC) |
| Toxics | Levels of toxic materials that support all life-history phases occupying the action area (App A)<br>• Low levels of chemical contamination from agricultural, industrial, or other sources | ODEQ 2002 CWA 303(d) database does not indicate that any streams in the McKenzie subbasin are water quality limited due to toxics | n/a |

[1]7 DADM = 7-day average of the daily maxima
[2]Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 11.0 mg/L criterion, dissolved oxygen levels must not be less than 95% saturation.
[3]Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 8.0 mg/L criterion, dissolved oxygen levels must not be less than 90% saturation.
[4]Appendix E in NMFS (2000)

Temperature

The USACE's Cougar and Blue River projects have altered downstream water temperatures in the mainstem McKenzie downstream to below Leaburg Dam (RM 38). Outflow temperatures have been cooler than inflow in the late spring and summer and warmer than inflow in fall and early winter (USACE 2000). By the time water reaches the mainstem McKenzie River, the effect of temperature shifts due to USACE operations is moderated by flows originating above the mouth of Blue River as well as equilibration between stream and ambient air temperatures over 8 miles between the mouth of Blue River and Leaburg Dam (USACE 2000). At Leaburg Dam, EWEB's Leaburg-Walterville Project begins to affect temperature by diverting water from two sections of the lower McKenzie, a 5.8-mile stretch between Leaburg Dam and the confluence with the tailrace of the Leaburg powerhouse (called the "Leaburg bypass reach") and a 7.3-mile section between the intake for the Walterville powerhouse and the point of confluence with the Walterville tailrace (the "Walterville bypass reach"). The water temperature model developed during the FERC-relicensing process predicted that, under a worst-case (hot and dry) climatological scenario, water temperatures could become elevated by 2.7°F and 3.6°F (1.5°C and 2.0°C), respectively, at the lower end of each mainstem bypass reach (NMFS and USFWS 2001).

Cooler water temperatures in the late spring and summer have probably impeded the upstream migration of spring chinook salmon compared to the predevelopment condition. Warmer fall/winter temperatures accelerate egg incubation and the timing of fry emergence. These factors may subject chinook salmon fry to unfavorable conditions such as high flows and scarce food, leading to poor survival. The apparent shift to later spawn timing could be a result of environmental conditions favoring late-emerging fry (Homolka and Downey 1995).

The USACE is modifying the intake structure on Cougar Dam to allow the water released below the dam to be drawn from different depths (i.e., temperature strata) in the forebay. After construction, the USACE plans to operate the project to restore stream temperatures in the South Fork McKenzie and to partially restore pre-project temperatures in the mainstem McKenzie River. The USACE expects to complete construction and begin to operate the Cougar water temperature control facility in 2004.

In 1993 and 1994, the USFS monitored water temperature at two sites near the Carmen-Smith Project: directly downstream of Trail Bridge Dam and at McKenzie Bridge (WNF MRD 1995). The monitoring data were displayed as 7-day average maximum water temperatures in order to compare the stream temperatures with Oregon Department of Environmental Quality (ODEQ) standards. At the monitoring site downstream of Trail Bridge Reservoir, water temperatures ranged between approximately 8.5°C and 9.5°C between June 17 and September 20, 1993, and between 8.5°C and 10.5°C over the same period in 1994. As expected, somewhat warmer temperatures were recorded at the McKenzie Bridge sampling site. These values are less than NOAA Fisheries' temperature criteria of <16ºC for core rearing, <18ºC for non-core rearing and migration, and <12.7ºC during spawning..

A more recent study of water temperature in the McKenzie River subbasin was that of Torgersen et al. (1999), who used remote sensing techniques to monitor stream temperature throughout much of the McKenzie River, South Fork McKenzie River, and Deer Creek. This study, using a technology known as forward-looking infrared technology, essentially is capable of providing a combination of temporally and spatially continuous data. Results from the survey of the McKenzie River subbasin showed an unusually gradual warming trend (0.1°C/km). Pronounced peaks and troughs in longitudinal profile that typically indicate strong tributary influences or differential heating were absent in the McKenzie River. The upper reaches of the river, between

Belknap Springs and Trail Bridge Reservoir exhibited distinct warming and cooling patterns. Torgersen et al. (1999) surmised that these observed fluctuations in temperatures (1°C) may be explained by geothermal inputs. Despite these warming trends, there were cooling trends observed in the river, suggesting the inflow of cool springs.

Dissolved Oxygen

In a USGS study (Pogue and Anderson 1995), dissolved oxygen concentrations in the lower mainstem McKenzie River (between RM 7.1 and 19.3) attained levels required for salmonid spawning and rearing during both the July and August 1994 sampling periods. The 2002 CWA 303(d) database shows that dissolved oxygen concentrations below ODEQ's numerical criterion for salmonid spawning (i.e., <11.0 mg/L or 95% saturation) were recorded at RM 1.5 in the Mohawk River, an unregulated tributary to the mainstem McKenzie, during October 1 through May 31.

Total Dissolved Gas

The ODEQ's 2002 CWA section 303(d) report does not indicate that the mainstem McKenzie River is limited by high total dissolved gas concentrations.

Turbidity

Turbidity is generally very low in the South Fork McKenzie and mainstem McKenzie rivers; background levels are less than 5 NTU. The USACE began to draw down Cougar Reservoir to prepare for construction of the water temperature control tower during spring 2002. As the reservoir level fell, the South Fork McKenzie River incised a channel through the sediment delta that had built up at the head of the reservoir over 30 years (since construction). Some of the sediments remobilized by this process were released from Cougar Reservoir in a turbid plume, detectable from April through July, 2002. The median turbidity measured at USGS Station No. 14159500, approximately ½ mile below the dam, from April 1 through June 16 was 98 NTU, and the measurements included a maximum of 379 NTU on April 28 (USACE 2003). The extended period of elevated turbidity raised questions about potential effects on spawning gravels, juvenile and adult spring chinook salmon, and macroinvertebrate communities that are integral to the chinook salmon food web (NMFS 2002).

In response to NOAA Fisheries' request to examine the effects of the sustained turbidity event, the USACE contracted with researchers from Oregon State University's Department of Geosciences and the USFS' Pacific Research Station to determine 1) to what extent and depth fine sediments associated with the reservoir drawdown intruded into gravels in the South Fork McKenzie below the dam, and 2) how much of the sediment released from the reservoir traveled in suspension through the McKenzie system and how much had settled out of suspension and was still stored in the subbasin. The first objective was addressed by Stewart et al. (2002), who concluded that there were higher proportions of fine sediments (especially clays) in the gravel bars below Cougar Dam compared to reaches above the reservoir. Clay enrichment was highest just below the dam and decreased rapidly downstream; there was no discernable effect of fines from Cougar Reservoir below the confluence of the South Fork and the mainstem McKenzie River. Stewart et al. could not prove that the clay enrichment below the dam occurred during the 2002 reservoir release because there were no pre-drawdown samples for comparison. However, Grant et al. (2002) observed that, after the spring 2002 turbidity events, clouds of sediment were stirred up in the South Fork below Cougar Dam, and to some extent in the mainstem McKenzie, and there did not seem to be a layer of fine sediment on the gravels above the dam. The Grant et al. (2002) observation that the turbidity event was probably the source of the fine sediment on the gravels below Cougar Dam was supported by D. Cushman, a USGS technician who has operated stream gages and monitors in the area (Anderson 2003).

The USACE collected samples of benthic invertebrates above and below Cougar Reservoir in August 2002 following the high turbidity events of spring 2002. The sampling design was intended to determine whether there had been immediate and catastrophic effects to benthic macroinvertebrate communities as a result of the recent drawdown and release of suspended materials. The analysis indicated that the "biotic integrity" of the benthic macroinvertebrate community below Cougar Dam was degraded in comparison to the community located above the reservoir (USACE 2003). However, the same trend was observed in samples collected in 2000 and 2001, before the drawdown. The USACE stated that this effect is not unusual for areas located below dams, citing studies in the Clackamas River system as an example.

<u>Nutrients</u>
The absence of functioning upstream passage facilities at EWEB's Trail Bridge Dam has eliminated a source of nutrients (chinook salmon carcasses) in the upper McKenzie system. ODFW has released live, marked adults from excess hatchery stock above Trail Bridge Dam to provide the missing carcasses. The ODEQ's 2002 CWA section 303(d) database does not indicate that any streams in the McKenzie subbasin are water quality limited due to excess nutrients.

<u>Toxics</u>
The ODEQ's 2002 CWA section 303(d) database does not indicate that any streams in the McKenzie subbasin are water quality limited due to toxics.

### *5.3 Status of Biological Requirements Under the Environmental Baseline*

The BRT (2003) described the McKenzie population of chinook salmon as one of the core populations in the UWR ESU and also stated that it represents an important portion of that species' genetic legacy. Under the environmental baseline, the abundance and productivity of the population declined from historical levels due to harvest, the influence of hatchery-origin spawners, blockage of historical habitat, and habitat degradation. The spatial distribution of the McKenzie population is constrained by passage barriers at Blue River Dam on the Blue River, Cougar Dam on the South Fork McKenzie River, and Trail Bridge Dam on the upper mainstem McKenzie River. Habitat quality has become degraded in occupied areas due to flow and land management activities, including changes in the frequency of channel forming flows, water diversion, loss of headwater and floodplain riparian vegetation, reduced large wood recruitment, substrate coarsening, loss of channel complexity; and seasonal temperature shifts and exceedences.

Abundances of the spring chinook salmon population in the McKenzie River are far below historical levels, and the BRT (2003) questioned whether population viability criteria were met. However, the McKenzie population is the largest remaining in the UWR chinook salmon ESU, and the BRT (2003) considered it self-sustaining. There are no data on trends in juvenile outmigrant production, but changes in the quality and quantity of freshwater rearing habitat are directly related to flow- and land-management activities within the subbasin. The decline in spatial distribution (due to barriers to historical habitat) and degradation of habitat indicate that biological requirements are not met in the action area under the environmental baseline.

# 6. EFFECTS OF THE PROPOSED ACTION

## *6.1 Methods for Evaluating the Effects Of Proposed Action*

In step 3 of the jeopardy analysis, NOAA Fisheries evaluates the effects of proposed actions on listed species and their habitat and seeks to answer the question of whether the species can be expected to survive with an adequate potential for recovery if those actions go forward. In section 6.2, NOAA Fisheries compares habitat conditions under the proposed action to properly functioning condition for UWR chinook salmon to determine effects on the viability of the McKenzie subbasin population. NOAA Fisheries then examines the likely effects of the proposed action on the viability of the ESU as a whole.

### *6.1.1 Methods for Evaluating the Effects of the Proposed Action in the Action Area*

This section describes the direct and indirect effects of the proposed action on listed salmonids and their habitat. As described in section 5.2, the depressed status of UWR chinook salmon in the action area is due in part to past operation of the Carmen-Smith Project. These effects include lack of access to historical spawning grounds above the projects, which does not appear to have been fully mitigated by the spawning channel below Trail Bridge Dam, and downstream changes in riparian vegetation, floodplain function, large wood processes, sediment transport, channel complexity, and possibly water quality. Effects are described as likely to "impair," "appreciably reduce," "retard," or "NR" (not reduce, retard, or impair) the status of biological requirements. NOAA Fisheries relates project effects to viability by considering effects on the survival or condition of individuals or the populations. For example, reducing project discharge to a level that dewaters redds would kill eggs and larvae, thereby limiting or even decreasing the abundance, productivity, and juvenile outmigrant production of the affected population. Impassible barriers that prevent access to historical habitat would increase the risk of losing the remaining population to some natural or manmade catastrophe (volcanic activity or landslides).

### *6.1.2 Methods for Evaluating the Effects of the Proposed Action on Biological Requirements at the Species Level*

The effects of the proposed action in the action area must be evaluated in the context of survival throughout the life cycle and compared with the jeopardy standard described in Chapter 1. In Chapter 5, NOAA Fisheries described the habitat factors limiting the viability of each population in the action area (at risk or not properly functioning). In this chapter, NOAA Fisheries follows this procedure to perform the analyses called for in step 3 in the jeopardy analysis framework:

- Determine which of the habitat factors that are at risk or not properly functioning are within the authority of the action agencies for this consultation.
- Estimate or describe the change in status of habitat factors that is likely to occur under the

proposed action (impair, reduce, or retard progress toward properly functioning condition).

- Describe the expected status of the surviving demographically independent populations in the action area if the proposed action goes forward.
- Determine whether the change in status of populations in the action area would provide the ESU a high likelihood of survival and a moderate to high likelihood of recovery.

## *6.2 Effects of the Proposed Action on Biological Requirements in the Action Area*

Biological requirements of the McKenzie subbasin population of spring chinook salmon are not met under the environmental baseline (section 5.2), and operation of EWEB's Carmen-Smith Project is partially responsible for the degraded condition. The primary effect of the Carmen-Smith Project is that Trail Bridge Dam blocks access to 7 miles of historically productive UWR chinook salmon spawning habitat (section 5.2.3). The spawning channel that EWEB built to mitigate for the lost spawning and rearing habitat has not consistently supported the 150-200 fish for which it was designed. Thus, FERC's proposed action includes a Conservation Measure for Fish Passage, in which EWEB would identify short-term interim upstream passage measures (i.e., that could potentially be in place by 2006). The scope of the Fish Passage Study would include the potential for injury and mortality of UWR chinook salmon caused by water level fluctuations above Trail Bridge Dam, entrainment in the turbine intake, or while passing over the spillway. This information would inform the resource agencies' decision to pass UWR chinook salmon above Trail Bridge Reservoir during the interim period, and in the long term after relicensing. Thus, NOAA Fisheries addresses the effects of two possible scenarios on the survival and recovery of UWR chinook salmon: 1) based on the results of the Fish Passage Study, EWEB would provide interim passage; and 2) EWEB would not provide interim passage and UWR chinook salmon continue to spawn and rear in an enhanced spawning channel.

### *6.2.1 Effects of the Action Without Interim Passage*

Table 6-1 summarizes the effects of the proposed action on UWR chinook salmon if EWEB does not provide passage above Trail Bridge Dam during the interim period before relicensing.

Table 6-1. Habitat characteristics of UWR chinook salmon in the McKenzie subbasin under the authority of the Action Agency, properly functioning condition, status under the environmental baseline, and effect of the proposed action, if EWEB does not provide passage for UWR chinook salmon above Trail Bridge Dam during the interim period. (Effects: Impair = impairs properly functioning condition; Reduce = appreciably reduces already impaired condition; Retard = retards long-term progress toward properly functioning condition; NR = does not reduce, retard, or impair properly functioning condition).

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Conditions Relative to Properly Functioning Condition | Effect of Proposed Action |
|---|---|---|---|
| Safe passage and access to historical habitat | Safe passage and access to spawning, rearing, and migration habitat needed for the viability of a demographically independent population | • Trail Bridge and Smith dams exclude spring chinook salmon from a portion of their historical range<br>• EWEB maintains a spawning channel downstream of Trail Bridge Dam that does not appear to have fully mitigated for the loss of upstream habitat<br>• *Not properly functioning* | • Retard |
| Large wood in mainstem McKenzie | Large wood (of sufficient frequency and composition) in the mainstem that retains sediment, creates hydraulic complexity, facilitates spawning gravel deposition and provides cover and habitat for invertebrates and anadromous salmonids<br>• Contains large wood accumulations along channel margins, and on bars or in channels within low-gradient reaches (specific benchmarks have not been developed) | • The upper McKenzie River below EWEB's Trail Bridge Dam is deprived of large wood<br>• *Not properly functioning* | • Retard |

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Conditions Relative to Properly Functioning Condition | Effect of Proposed Action |
|---|---|---|---|
| Sediment transport and deposition processes | Sediment transport and deposition processes that provide the bed material needed to create side channels, resting pools, bed complexity, and spawning gravel<br>• Sediment budget balanced by transport from upstream reaches, recruitment from floodplain, and deposition in alluvial reaches<br>• Large quantities of spawning gravel interspersed with bedrock and cobble reaches | • Trail Bridge and Smith reservoirs trap sediment from the upper McKenzie and Smith watersheds, and substrate may have coarsened downstream of Trail Bridge Dam<br>• *Not properly functioning* | • Retard |
| Channel complexity | Channel complexity that provides hydraulic variation, hyporheic connectivity, and habitat need by rearing, holding, and spawning anadromous salmonids<br>• Side channels and alcoves present in alluvial reaches, frequent erosion and creation of channel features | • Length of side channel habitat has decreased downstream of Trail Bridge Dam<br>• *Not properly functioning* | • Retard |

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Conditions Relative to Properly Functioning Condition | Effect of Proposed Action |
|---|---|---|---|
| Water temperature | Water temperatures that support all life-history phases occupying the action area<br>• Maximum temperatures (7 DADM[1]) that do not exceed EPA recommendations for summer maximum temperatures for spawning, incubation, fry emergence, core and non-core rearing, adult and juvenile migration, and steelhead smoltification<br>• Minimum temperatures that do not fall below 52°F (11°C) during adult chinook salmon migrations | • Temperature in the McKenzie River downstream of Trail Bridge Dam (RM 53-83) supports all life history phases of chinook salmon<br>• *Properly functioning (upstream of RM 53)* | • NR |

[1]7 DADM = 7-day average of the daily maxima

Safe Passage and Access to Historical Habitat

If passage is not provided in the interim at the Carmen-Smith Project, then the primary effect of continued operation is blocked access to historical habitat, with consequent limits on the abundance, productivity, and spatial distribution of the subbasin population. UWR chinook salmon would continue to use the spawning channel downstream of Trail Bridge Dam, which does not appear to have consistently supported the numbers of spawners for which it was designed (section 6.2).

As part of the proposed action, FERC proposes that EWEB would replenish and enhance the spawning channel used by spring chinook salmon by adding spawning gravel during the in-water work period from July 1 through August 15. Spawning gravel enhancement would be performed in cooperation with the USFS McKenzie River Ranger District, which manages the site where the channel is located. Implementation would occur in 2003 or 2004, depending upon when the USFS's NEPA process is completed and necessary fill and removal authorization, if any, is obtained. The USFS has completed a Section 7(a)(2) consultation for this activity under the

ESA. While a lack of passage at Trail Bridge Dam would continue to block UWR chinook salmon from historical habitat, the action proposed by this conservation measure would improve the capacity of the spawning channel so that it would be more likely to accommodate the number of spawners for which it was designed. EWEB would also reclaim and improve side-channel habitat downstream of Trail Bridge Dam, providing additional rearing habitat for juvenile UWR chinook salmon originating within the spawning channel.

<u>Flow and Hydrology</u>
As discussed in section 5.3, EWEB operates Carmen-Smith Project as a run-of-river project and thus it does not alter the flow regime of the McKenzie River below Trail Bridge Dam.

<u>Large Wood, Sediment Transport, and Channel Complexity</u>
Approximately 14% of the McKenzie subbasin is blocked by Trail Bridge Dam. Trail Bridge, Smith, and Carmen dams disrupt sediment and large wood dynamics such that the habitat downstream has been simplified. Minear (1994) found that between 1949 and 1986, the number and total length of side channels declined along the mainstem McKenzie River downstream of Trail Bridge Dam (i.e., but upstream of the confluences of the South Fork and Blue River), indicating channel downcutting and abandonment of side channels. In addition, Sedell et al. (1992) found that larger substrates were more abundant in the upper mainstem in 1991 than in 1937, indicating that bedload coarsening has occurred within the action area. These changes are most likely the result of sediment interception by the three-dam Carmen-Smith Project.

The loss of large wood results in simplification of stream structure through loss of scour sources, flow deflection, and sediment storage capability. Minear (1994) and WNF MRD (1995) found that simplification of stream structure has occurred in the last several decades downstream of Trail Bridge Dam due to reduced quantities of large wood, channelization by riprap and roads, and alteration of riparian vegetation. The downstream extent of these effects decreases with distance as major undammed tributaries enter the mainstem McKenzie River. For example, Deer, Lost, and Horse creeks all enter the upper mainstem McKenzie River within about 15 miles of Trail Bridge Dam, providing sediment and large wood inputs (WNF MRD 1995, 1997), and thus reducing the effect of the Carmen-Smith Project on these habitat processes.

The proposed continued operation of the Carmen-Smith Project is likely to continue degrading the sediment and large wood habitat processes in the upper McKenzie River channel downstream of Trail Bridge Dam. The loss of side channel habitat, streambed coarsening, down-cutting, and reduced large pool habitat reduces available holding, spawning, and rearing habitat for UWR chinook salmon. This effect would continue, and conditions would degrade even further, under the proposed action.

To restore habitat to properly functioning condition, FERC proposed that EWEB would reclaim and improve side channel habitat (spawning, rearing, foraging, and over-wintering habitat) for spring chinook salmon and bull trout in the McKenzie River below Trail Bridge Dam. EWEB would provide funding in an amount not to exceed a total of $50,000 to the USFS McKenzie River Ranger District to pay actual project costs for enhancement of one or two top-priority side-channel sites within an approximately 23-mile section of the mainstem river from Trail Bridge Dam downstream to Dearborn Island. These restoration projects would increase availability of rearing, holding, and possibly spawning habitat for UWR chinook salmon and minimize adverse effects on habitat requirements of UWR chinook salmon resulting from the continued interception of sediment and large wood by the Carmen-Smith Project. Additionally, EWEB proposes a Hydrogeomorphic Study to more accurately determine the effects of the Carmen-Smith Project on sediment dynamics and large wood function within and below the Carmen-Smith Project. The results of the study would be used to inform long-term habitat restoration actions in upcoming relicensing proceedings.

Water Quality

Water temperature in the McKenzie River between Trail Bridge Dam and RM 54 meet the criteria for all stages of the chinook salmon life cycle (properly functioning condition), but exceed criteria for bull trout spawning and rearing. No information is available to determine whether the Carmen-Smith Project has altered water temperatures below Carmen, Smith, and Trail Bridge dams. Thus, EWEB proposes to complete a water temperature study to provide baseline data on water temperature effects caused by the Carmen-Smith Project dams and reservoirs. These data would be utilized during the relicensing process for development of long term actions, if needed, to minimize the effects of the Carmen-Smith Project on stream temperatures within and below the project. While it is reasonable to expect that operations of the Carmen-Smith Project temperatures could increase water temperatures in the McKenzie River, NOAA Fisheries does not expect project operations to adversely affect UWR chinook salmon, since water temperatures in the 30-mile reach below Trail Bridge Dam already meet the criteria for all stages of chinook salmon life cycle, and would continue to meet the criteria if changes were made to protect bull trout.

Summary

If interim passage is not provided, the Carmen-Smith Project would continue to block access to 7 miles of historical spawning and rearing habitat (limiting spawning to the spawning channel), and continue to disrupt large wood and sediment transport downstream of Trail Bridge Dam, which would adversely affect holding and rearing habitat. EWEB proposes to minimize these effects by improving conditions within the spawning channel and enhancing holding and rearing habitat in the reach of the McKenzie River downstream of Trail Bridge Dam.

### *6.2.2 Effects of the Action With Interim Passage*

Table 6-2 summarizes the effects of the proposed action on UWR chinook salmon if EWEB provides passage above Trail Bridge Dam during the interim period before relicensing.

Table 6-2. Habitat characteristics of UWR chinook salmon in the McKenzie subbasin under the authority of the Action Agency, properly functioning condition, status under the environmental baseline, and effect of the proposed action, if EWEB provides passage for UWR chinook salmon above Trail Bridge Dam during the interim period. (Effects: Impair = impairs properly functioning condition; Reduce = appreciably reduces already impaired condition; Retard = retards long-term progress toward properly functioning condition; NR = does not reduce, retard, or impair properly functioning condition).

| **Habitat Characteristic** | **Properly Functioning Condition** | **Description of Current (Baseline) Conditions Relative to Properly Functioning Condition** | **Effect of Proposed Action** |
|---|---|---|---|
| Safe passage and access to historical habitat | Safe passage and access to spawning, rearing, and migration habitat needed for the viability of a demographically independent population | • Trail Bridge and Smith dams exclude spring chinook salmon from a portion of their historical range<br>• EWEB maintains a spawning channel downstream of Trail Bridge Dam to mitigate for habitat blockage by providing spawning and rearing habitat for up to 150-200 spawners<br>• *Not properly functioning* | • NR |
| Flow fluctuations | • Gradual flow fluctuations that allow normal behavioral adjustments by anadromous fish. | • Flow fluctuations within Trail Bridge Reservoir occur at rapid rates that may cause entrapment and stranding of juvenile UWR chinook salmon<br>• *At risk* | • reduce |
| Seasonal Flows | • Sufficient flow to support successful, spawning, and migrating salmonids<br>• Sufficient flow to maintain water temperatures within recommended criteria | • The upper McKenzie River just below Tamolich Falls experiences low flows, which may be exacerbated by diversion at Carmen Dam<br>• *At risk* | • possibly reduce |

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Conditions Relative to Properly Functioning Condition | Effect of Proposed Action |
|---|---|---|---|
| Large wood in mainstem McKenzie | Large wood (of sufficient frequency and composition) in the mainstem that retains sediment, creates hydraulic complexity, facilitates spawning gravel deposition and provides cover and habitat for invertebrates and anadromous salmonids<br><br>• Contains large wood accumulations along channel margins, and on bars or in channels within low-gradient reaches (specific benchmarks have not been developed) | • The upper McKenzie River below EWEB's Trail Bridge Dam is deprived of large wood<br><br>• *Not properly functioning* | • NR |

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Conditions Relative to Properly Functioning Condition | Effect of Proposed Action |
|---|---|---|---|
| Sediment transport and deposition processes | Sediment transport and deposition processes that provide the bed material needed to create side channels, resting pools, bed complexity, and spawning gravel<br>• Sediment budget balanced by transport from upstream reaches, recruitment from floodplain, and deposition in alluvial reaches<br>• Large quantities of spawning gravel interspersed with bedrock and cobble reaches | • Trail Bridge and Smith reservoirs trap sediment from the Upper McKenzie and Smith watersheds, and substrate may have coarsened downstream of Trail Bridge Dam<br>• *Not properly functioning* | • NR |
| Channel complexity | Channel complexity that provides hydraulic variation, hyporheic connectivity, and habitat need by rearing, holding, and spawning anadromous salmonids<br>• Side channels and alcoves present in alluvial reaches, frequent erosion and creation of channel features | • Length of side channel habitat has decreased downstream of Trail Bridge Dam<br>• *Not properly functioning* | • NR |

| Habitat Characteristic | Properly Functioning Condition | Description of Current (Baseline) Conditions Relative to Properly Functioning Condition | Effect of Proposed Action |
|---|---|---|---|
| Water temperature | Water temperatures that support all life-history phases occupying the action area<br>• Maximum temperatures (7 DADM[1]) that do not exceed EPA recommendations for summer maximum temperatures for spawning, incubation, fry emergence, core and non-core rearing, adult and juvenile migration, and steelhead smoltification<br>• Minimum temperatures that do not fall below 52°F (11°C) during adult chinook salmon and steelhead migrations | • Temperature in the McKenzie River downstream of Trail Bridge Dam (RM 54-83) supports all life history phases of chinook salmon<br>• *Properly functioning* | • NR |
| Nutrients | Nutrient levels that support all life-history phases occupying the action area<br>• No excess nutrients from agricultural, industrial, or other sources<br>• Adequate supply of marine derived nutrients to habitat in the upper watershed | • Supply of natural marine-derived nutrients to McKenzie headwaters and the Smith River had ceased, but in recent years, ODFW has released hatchery adults to provide the missing carcasses<br>• At risk | • NR |

[1]7 DADM = 7-day average of the daily maxima

Safe Passage and Access to Historical Habitat

There is little information regarding some of potential adverse effects (e.g., entrainment, stranding, predation) of passage above Trail Bridge Dam on UWR chinook salmon. As part of FERC's proposed action, EWEB would evaluate these uncertainties. The Stranding Study would identify the likelihood that juvenile chinook salmon would be stranded by fluctuating reservoir levels. The Entrainment Study would identify the potential risks to juvenile outmigrants passing through the turbine intake or spillway gate, and would propose interim actions to minimize injury and mortality. The decision to pass fish above Trail Bridge Dam would be made by the resource agencies only if doing so would provide a net benefit in terms of population abundance and productivity.

Flow and Hydrology

EWEB operates the Carmen-Smith Project as a run-of-river project and thus it does not alter the flow regime in the McKenzie River below Trail Bridge Dam. However, FERC has not proposed minimum releases below Carmen and Smith dams during the interim period, so the flow regime within the Carmen-Smith Project, particularly the bypass reaches below Smith Dam in the Smith River, below the Carmen Dam in the McKenzie River, and within Trail Bridge Reservoir would continue to be significantly impacted by the proposed action.

Diversion of water at Carmen and Smith dams causes flows in the respective bypass reaches to be low. Despite perennial inflow from Bunchgrass Creek, which enters the Smith River just below Smith Dam, flows in this bypass reach are low due to diversions into the power tunnel at Smith Dam. Similarly, ground water upwelling below Tamolitch Falls provides perennial flow to the bypass of the McKenzie River below Carmen Dam, but flows are still very low, most likely from diversion at the Carmen Dam. These low flows may not provide adequate spawning and rearing habitat in the two bypass reaches.

As discussed in section 3.1.4, the Carmen powerhouse is operated as a peaking facility, so flow into Trail Bridge Reservoir from this facility fluctuates dramatically. Consequently, water levels in Trail Bridge Reservoir (a re-regulating facility) fluctuate on a daily basis, absorbing the peaking operation of the Carmen powerhouse and assuring that the ramping rates in the McKenzie River downstream of Trail Bridge Dam are less than 2 inches per hour (as required by the existing FERC license). Daily water level fluctuations in Trail Bridge Reservoir vary, but are limited by the existing FERC license to 7 feet per day between Memorial Day and Labor Day of each year (FERC 2003). There are no license restrictions on reservoir water level fluctuations the rest of the year, and water levels can vary as much as 12 feet per day. These daily fluctuations in reservoir levels could have adverse effects listed UWR chinook salmon, including increased risk of stranding, altered ability to migrate into tributary streams entering the reservoir, and potentially reduced food base along the margin of Trail Bridge Reservoir. EWEB proposes a Stranding Study to assess the potential stranding of chinook salmon and bull trout within and below the Carmen-Smith Project associated with typical daily fluctuations under the project's normal operations. The decision by resources agencies to pass UWR chinook salmon above Trail Bridge Dam would incorporate the results of this study.

Large Wood, Sediment Transport, and Channel Complexity
All of the adverse effects of the Carmen-Smith Project on large wood, sediment, and channel complexity discussed in section 6.2.1 would occur if EWEB passes UWR chinook salmon above Trail Bridge Dam.

The Carmen-Smith Project also affects large wood, sediment, and channel complexity within the Carmen-Smith Project, above Trail-Bridge Reservoir. Large wood and sediment interception at Smith Dam and at Carmen Dam have likely resulted in the coarsening of bed materials, down-cutting, reduced habitat complexity, and reduction in large pools (FERC 2003). The coarseness of substrate between Tamolich Falls (McKenzie River) and Trail Bridge Reservoir may be natural due to the subsurface flow regime upstream, alhough the potential for sediment and large wood transport at high flows has not been examined (FERC 2001). The proposed action would continue to degrade the habitat process of sediment and large wood function in the upper McKenzie River and Smith River bypass reaches upstream from Trail Bridge Reservoir.

The effects of the action on these habitat processes could reduce the availability of spawning and rearing habitat for UWR chinook salmon. However, EWEB proposes habitat improvements upstream of Trail Bridge Dam to improve habitat for bull trout and UWR chinook salmon. EWEB would provide funding in an amount not to exceed a total of $50,000 to the USFS McKenzie River Ranger District to pay actual project costs of placing approximately 60 pieces of large wood in a 1-mile reach of the McKenzie River from the head of Trail Bridge Reservoir upstream to Kink Creek. The USFS plans to implement this project in 2003 or 2004 depending upon when the USFS's NEPA process (currently under way) is completed. This restoration project would increase availability of rearing, and possibly spawning habitat for UWR chinook salmon and minimize adverse effects on habitat requirements of UWR chinook salmon resulting from the continued interception of sediment and large wood by the Carmen and Smith dams, should listed UWR be passed above Trail Bridge Dam.

As described in section 6.2.1, EWEB also proposes habitat improvements downstream of Trail Bridge Dam. These restoration projects would increase availability of rearing, holding, and possibly spawning habitat for UWR chinook salmon and minimize adverse effects on habitat requirements of UWR chinook salmon from the continued interception of sediment and large wood by the Carmen-Smith Project. As described in section 6.2.1, the Hydrogeomorphic Study proposed by EWEB will inform long-term habitat restoration actions in upcoming relicensing proceedings.

*Water Quality*

As discussed in section 6.2.1, water temperature in the McKenzie River between Trail Bridge Dam and RM 54 meets the criteria for all stages of the chinook salmon life cycle (properly functioning condition).

Nutrient cycling has likely been substantially altered in the upper McKenzie subbasin due to a lack of upstream fish passage facilities at Smith or Trail Bridge dams. Stream reaches above Trail Bridge Dam are nutrient-poor because of the volcanic geology. Historically, chinook salmon carcasses likely constituted an important source of nitrogen for the stream reaches above Trail Bridge Dam, and the elimination of these carcasses by dam construction may have significantly reduced stream productivity above the dam. However, specific information on the magnitude of this effect is not available.

In recent years, ODFW has transported live excess hatchery chinook salmon into the watershed above Trail Bridge Dam. The objective of this effort was in part to promote the natural production and subsequent establishment of juvenile chinook salmon fry and fingerlings for bull trout forage. The spawner carcasses have likely contributed to increased ecosystem productivity (and increased macroinvertebrate production) by reestablishing marine derived nutrients to the upper McKenzie River watershed. FERC proposes that EWEB reimburse ODFW (not to exceed $1,000 annually) for transferring excess hatchery chinook salmon above Trail Bridge Dam. However, if listed UWR are passed upstream of Trail Bridge Reservoir, then the need for supplementation with hatchery fish would cease. The previous supplementation of hatchery fish (and associated marine-derived nutrients) would likely benefit rearing juveniles within the first few years after passage until the nutrients from the carcasses from the natural-origin UWR chinook salmon are incorporated into the ecosystem.

*Summary*
If interim passage is provided, then UWR chinook salmon would have access to 7 additional miles of historical habitat. While the Carmen-Smith Project would adversely effect UWR chinook salmon if they are passed upstream of Trail Bridge Dam (e.g., injury and mortality caused by entrainment in the turbine intake or spillway gate, stranding, predation), the magnitude of these effects are currently unknown. However, EWEB proposes numerous studies that would describe these effects, and the results of those studies would be incorporated into the resource agencies' decision to pass UWR chinook salmon upstream of Trail Bridge Reservoir in the interim. EWEB also proposes to implement habitat restoration projects both upstream and downstream of Trail Bridge Dam, which would minimize the adverse effects of large wood and sediment retention behind the Carmen-Smith Project.

## *6.3 Effects of the Trail Bridge Emergency Spillway Expansion*

The construction of the Trail Bridge emergency spillway expansion would not involved dredging, filling, or in-water work, nor would it significantly disturb riparian trees. EWEB proposes to use best management practices to prevent any construction discharge to surface water. Thus, NOAA Fisheries does not expect the construction of the Trail Bridge Dam emergency spillway expansion to directly affect UWR chinook salmon, or to adversely affect habitat characteristics needed to meet the biological requirements of chinook salmon.

# 7. CUMULATIVE EFFECTS

Cumulative effects, as defined in 50 CFR §402.02, include the effects of future State, tribal, local, or private actions, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions requiring separate consultations pursuant to Section 7 of the ESA are not considered here.

State, tribal, and local government actions are likely to be in the form of legislation, administrative rules, or policy initiatives. Government and private actions may include changes in land and water-use patterns, including ownership and intensity, any of which could affect listed species or their habitat. Even actions that are already authorized are subject to political, legislative, and fiscal uncertainties. These realities, added to the geographic scope of the action area, which encompasses numerous government entities exercising various authorities and many private landholdings, make any analysis of cumulative effects difficult. This section identifies representative actions that, based on currently available information, are reasonably certain to occur. It also identifies goals, objectives and proposed plans by state and tribal governments; however, NOAA Fisheries is unable to determine at this time whether such proposals would in fact result in specific actions.

## *7.1 State Actions*

Most future actions by the state of Oregon are described in the Oregon Plan for Salmon and Watershed, which includes the following programs designed to benefit salmon and watershed health:

- Oregon Department of Agriculture water quality management plans.
- ODEQ development of total maximum daily loads (TMDLs) in targeted basins and implementation of water quality standards.
- Oregon Watershed Enhancement Board funding programs for watershed enhancement programs, and land and water acquisitions.
- ODFW and OWRD programs to enhance flow restoration.
- OWRD programs to diminish over-appropriation of water sources
- ODFW and Oregon Department of Transportation programs to improve fish passage; culvert improvements/replacements.
- Oregon Department of Forestry state forest habitat improvement policies and the Board of Forestry pending rules addressing forestry effects on water quality and riparian areas.
- Oregon Division of State Lands and Oregon Parks Department programs to improve habitat health on state-owned lands.
- Department of Geology and Mineral Industries program to reduce sediment runoff from mine sites.
- State agencies funding local and private habitat initiatives, technical assistance for establishing riparian corridors, and TMDLs.

If these were implemented, they could improve habitat features considered important for the listed species. However, the Oregon legislature has not allocated funding for a number of these programs.

The Oregon Plan also identifies private and public cooperative programs for improving the environment for listed species. The success and effects of such programs would depend on the continued interest and cooperation of the parties. One such cooperative program, the Willamette Restoration Initiative, has developed the Willamette Restoration Strategy, which serves as the Willamette basin section of the Oregon Plan.

In the past, Oregon's economy depended on natural resources, with intense resource extraction. Changes in the state's economy have occurred in the last decade and are likely to continue, with less large-scale resource extraction, more targeted extraction, and some growth in other economic sectors. Growth creates urbanization pressures and increased demands for buildable land, electricity, water supplies, waste-disposal sites, and other infrastructure. Economic diversification in the 1990s contributed to population growth and movement, a trend likely to continue for the next few years. Such population trends would result in greater overall and localized demands for electricity, water, and buildable land in the action area; would affect water quality directly and indirectly; and would increase the need for transportation, communication, and other infrastructure. The impacts associated with these economic and population demands would probably affect habitat features such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect would be negative, unless carefully planned for and mitigated.

Some of the state programs described above are designed to address these impacts. Oregon also has a statewide, land-use-planning program that sets goals for growth management and natural resource protection. If this program continues, it may help lessen the potential for the adverse effects discussed above.

### *7.2 Local Actions*

Local governments will be faced with similar and more direct pressures from population growth and movement. There will be demands for intensified development in rural areas, as well as increased demands for water, municipal infrastructure, and other resources. The reaction of local governments to growth and population pressure is difficult to assess without certainty in policy and funding. In the past, local governments generally accommodated growth in ways that adversely affected listed fish habitat. Because there is little consistency among local governments regarding current ways of dealing with land use and environmental issues, both positive and negative effects on listed species and their habitat are probably scattered throughout the action area.

In Oregon, local governments are considering ordinances to address effects on aquatic and fish habitat from different land uses. The programs are part of state planning structures. Local governments may also participate in regional watershed health programs, although political will and funding will determine participation and, therefore, the effect of such actions on listed species. Overall, unless beneficial programs are comprehensive, cohesive, and sustained in their application, it is not likely that local actions will have measurable positive effects on listed species and their habitat and may even contribute to further degradation.

### *7.3 Tribal Actions*

Tribal governments will continue to participate in cooperative efforts involving watershed and basin planning designed to improve aquatic and fish habitat. The results of changes in tribal forest and agricultural practices, in water resource allocation, and in land use are difficult to assess, for the reasons discussed in sections 7.1 and 7.2. The earlier discussion of the effects of economic diversification and growth applies also to tribal government actions. The tribal governments have to apply and sustain comprehensive and beneficial natural resource programs such as the ones described below, to areas under their jurisdiction, to have measurable positive effects on listed species and their habitat.

One tribal program illustrates future tribal actions that should have such positive effects. The *Wy-Kan-Ush-Mi Wa-Kish-Wit*, or "Spirit of the Salmon," plan is a joint restoration plan for anadromous fish in the Columbia River basin prepared by the Nez Perce, Umatilla, Warm Springs, and Yakama tribes. It provides a framework for restoring anadromous, or sea-going, fish stocks, specifically salmon, Pacific lamprey (eels), and white sturgeon in upriver areas above Bonneville Dam. The plan emphasizes strategies and principles that rely on natural production and healthy river systems. The plan's technical recommendations cover hydro operations on the mainstem Columbia and Snake rivers; habitat protection and rehabilitation in the basin above Bonneville Dam, in the Columbia estuary, and in the Pacific ocean; fish production and hatchery reforms; and in-river and ocean harvests.

The Nez Perce, Umatilla, Warm Spring, and Yakama tribal governments are now seeking to implement this plan and salmon restoration in conjunction with the states, other tribes, and the Federal government, as well as in cooperation with their neighbors throughout the basin's local watersheds and with other citizens of the Northwest.

Overall, the Spirit of the Salmon plan should have positive cumulative effects on listed species and their habitat.

### *7.4 Private Actions*

The effects of private actions are the most uncertain. Private landowners may convert their lands from current uses, or they may intensify or diminish those uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or they may result from growth and economic pressures. Changes in ownership patterns will have unknown impacts.

Whether any of these private actions will occur is highly unpredictable, and the effects are even more so.

### *7.5 Summary*

Non-Federal actions are likely to continue affecting listed species. The cumulative effects in the action area are difficult to analyze, considering the broad geographic landscape covered by this Opinion, the geographic and political variation in the action area, the uncertainties associated with government and private actions, and ongoing changes to the region's economy. Although state, tribal, and local governments have developed plans and initiatives to benefit listed salmon and steelhead, they have not been applied and sustained in a comprehensive manner. Therefore, NOAA Fisheries cannot consider them "reasonably foreseeable" in its analysis of cumulative effects.

# 8. CONCLUSION

The analysis in the preceding sections of this Opinion forms the basis for conclusions as to whether the proposed action, the continuing operation of the Carmen-Smith Project and Trail Bridge Emergency Spillway Expansion, satisfies the standards of ESA Section 7(a)(2). To satisfy those standards, the proposed action must not be likely to jeopardize the continued existence of any listed species or destroy or adversely modify the designated critical habitat of such species. Chapter 4 of this Opinion defines the current range-wide status of UWR chinook salmon. Chapter 5 evaluates the relevance of the environmental baseline to the species' current status. Chapter 6 describes the likely effects of the proposed action on habitat requirements, on individuals, on the population in the action area, and the listed population as a whole across its range and life cycle. Chapter 7 considers the cumulative effects of relevant non-Federal actions reasonably certain to occur within the action area. In this chapter, the basis of the information and analyses presented above, NOAA Fisheries determines whether the Trail Bridge Emergency Spillway Expansion and continued operation of the Carmen-Smith Project would jeopardize the survival and recovery of the UWR chinook salmon ESU.

<u>Status of UWR Chinook Salmon under the Environmental Baseline</u>
As discussed in Chapter 4, historically, five major subbasins in the upper Willamette system produced spring chinook salmon: the Clackamas, North Santiam, South Santiam, Middle Fork Willamette, and McKenzie rivers. Between 1952 and 1968, dams were built on all of the major tributaries occupied by spring chinook salmon, blocking over half of the most productive spawning and rearing habitat. Water management operations have reduced the quality of the remaining spawning and rearing habitat in downstream areas. In particular, the release of relatively warm water during autumn leads to the early emergence of stream-type chinook salmon fry and relatively cold water released during summer may delay spawning migrations. Mitigation hatcheries, built to offset the substantial habitat losses resulting from dam construction, maintained broodlines that are relatively free of genetic influences from outside the basin, but may have homogenized within-basin stocks, simplifying the population structure of the ESU. The number of naturally-spawning fish has increased in recent years, but NOAA Fisheries believes that many are probably first-generation hatchery fish.

<u>Status of the McKenzie Subbasin Population under the Environmental Baseline</u>
At this time, chinook salmon in the McKenzie River above Leaburg Dam constitute the largest remaining spawning aggregation of wild fish in the UWR ESU (approximately 40% of the ESU's production potential). Within the action area, the viability of the population has been limited in the following ways:

- Storage and release operations at the USACE's Cougar and Blue River dams have reduced the frequency and magnitude of channel-forming floods, which has resulted in relatively static and simplified aquatic habitat compared to that needed for successful spawning, rearing, migration, and growth and development.
- Storage and release operations at the USACE's Cougar and Blue River dams have altered

the annual hydrograph, reducing peak flows in the winter and spring and increasing low flows in the summer and fall.

- Leaburg Dam, constructed in 1929, initially blocked the downstream transport of sediment in the lower McKenzie River, resulting in a 1- to 5-foot downcutting of the bed (i.e., until Leaburg Lake filled in and once again passed gravel to spawning areas downstream).
- Construction of the USACE's Cougar and Blue River dams trapped both sediment and large wood in the upper subbasin, reducing transport to spawning habitat in the Leaburg and Walterville reaches.
- Large wood was directly removed from stream channels of all sizes in a misdirected effort to improve fish passage, for timber salvage, to reduce downstream damage to bridges during floods, and to prevent navigation hazards.
- Much of the riparian vegetation was removed for farmland, residences, timber harvest, and roads, reducing the acreage covered and functional value of the riparian zone.
- Altered flow regime and the construction of flood control structures (levees and revetments) affected channel morphology: a decrease in the creation of new bars and islands, bank erosion, channel meandering, and the migration of channel bars (decreased spawning, holding, and rearing habitat).
- Until 2002, up to 14.5% passage mortality of chinook salmon smolts entrained into the Walterville Canal and powerhouse; significant delay of adults at the Walterville tailrace (until 2003); significant delay of adults at the Leaburg tailrace (until 2004); delay at the Leaburg fish ladder (until 2004, under terms of new FERC license).
- Diversion from the mainstem McKenzie River, leaving as low as 465 cfs in the 5.8 mile Leaburg reach and as low as 350 cfs during a portion of the year (fall-spring) in the 7.3 mile Walterville reach (bypass reaches) until 1991 affected rearing, in-stream temperature, and migration for juvenile and adult chinook salmon (minimum flow increased to 1000 cfs in 1990).

Thus, the biological requirements of the McKenzie subbasin population of UWR chinook salmon are not met under the environmental baseline. Next, NOAA Fisheries considers the effects of the proposed action under consultation.

<u>Effects of the Trail Bridge Dam Emergency Spillway Expansion and Continued Operations of the Carmen-Smith Project</u>

The construction of the Trail Bridge Dam Emergency Spillway Expansion will not jeopardize the continued existence of UWR chinook salmon.

The operation of the Carmen-Smith Project has contributed to the decline of UWR under the environmental baseline, and in the following ways, and would continue to do so under the proposed action:

- Trail Bridge and Smith dams eliminate access to 7 miles of historical spawning and rearing habitat upstream of Trail Bridge Dam. The spawning channel constructed to

mitigate for this does not appear to have consistently supported the number of spawners for which it was designed.
- The project traps 14% of large wood and sediment from the McKenzie basin in Carmen, Smith, and Trail Bridge reservoirs. This has contributed to streambed coarsening, downcutting, and a decline in side channel and pool habitat, reducing the quantity of holding, spawning, and rearing habitat in the mainstem McKenzie River downstream of Trail Bridge Dam.

These adverse effects have limited the viability of the McKenzie population of UWR chinook salmon, and the ESU as a whole.

<u>Proposed Measures to Minimize Adverse Effects of the Continued Operations during the Interim Period</u>
By implementing the proposed action, FERC would ensure that EWEB takes all available measures at the Carmen-Smith Project to minimize the effects of continuing operations on factors that currently limit the productivity of the ESU:

- FERC proposes that EWEB would reclaim and enhance side channel habitat downstream of Trail Bridge Dam, which will increase availability of spawning, holding, and rearing habitat for UWR chinook salmon.
- FERC proposes that EWEB would enhance the spawning channel downstream of Trail Bridge Dam, which will increase availability of spawning and rearing habitat for UWR chinook salmon.
- FERC proposes that EWEB would perform a Fish Passage Study that could result in interim upstream fish passage prior to relicensing in 2008. If EWEB provides interim upstream passage at Trail Bridge Dam, additional adverse effects on listed UWR could occur. While there is currently little information regarding the magnitude of these effects, the resource agencies' decision to pass listed UWR chinook salmon above Trail Bridge Dam would be informed by studies that would address the potential for injury and mortality associated with entrainment into the turbine intake and spillway gate, predation, and stranding. NOAA Fisheries would not direct EWEB to pass UWR chinook salmon above Trail Bridge Dam unless the benefits of passage outweighed the adverse effects identified in the studies (i.e., increased viability of the subbasin population).

While these interim actions are necessary to minimize take asssociated with continuing operation of the Carmen-Smith Project in the interim period, they should not preclude any decisions made at relicensing. For example, the interim passage facility should not prevent future use of the spawning channel.

Available information is insufficient to determine if the proposed action would improve the status of UWR chinook salmon to the point at which biological requirements would be fully met within the action area. However, NOAA Fisheries expects ongoing W/LC TRT efforts, and

EWEB's proposed studies to be completed during the interim period (the term of this Opinion), will generate much of the needed information.

Although some uncertainties exist, the best available information suggests that UWR chinook salmon would continue to survive and retain the potential to recover if the proposed action is implemented during the interim period (until a new FERC license becomes final, but no later than 2013). Because FERC's proposed action would provide the benefits listed above, NOAA Fisheries concludes that these benefits will be sufficient to reduce the likelihood of extinction while studies are completed during relicensing. Therefore, NOAA Fisheries concludes that the proposed action, with the effects of the environmental baseline and cumulative effects, is consistent with biological requirements, and is not likely to jeopardize the continued existence of UWR chinook salmon during the term of this Opinion.

# 9. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by regulation as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

This incidental take statement specifies the amount or extent of any authorized incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize incidental take and sets forth terms and conditions with which the action agency must comply in implementing the reasonable and prudent measures.

The measures described below are non-discretionary, and must be undertaken by FERC and EWEB so that they become binding conditions of any permit, license, or other approval issued to EWEB for the exemptions in Section 7(o)(2) to apply. FERC has a continuing duty to regulate the activity covered by this incidental take statement. If FERC 1) fails to assume and implement the terms and conditions or 2) fails to require EWEB to adhere to the terms and conditions of the incidental take statement, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, FERC and/or EWEB must report the progress of the action and its impact on the species to NOAA Fisheries as specified in this incidental take statement (50 CFR §402.14(I)(3)).

## *9.1 Amount or Extent of Incidental Take*

NOAA Fisheries is reasonably certain the proposed action will result in incidental take of listed species, which are known to occur in the action area. For the purposes of this Opinion, incidental take is defined as take of UWR chinook salmon individuals (fertilized eggs, fry, juveniles, or adults) that results from the continuing operation of the Carmen-Smith Project until a new license is final (but no later than 2013). Despite the use of best scientific and commercial data available, NOAA Fisheries cannot quantify a specific amount of incidental take of individual fish or incubating eggs for the proposed action. However, NOAA Fisheries expects the extent of incidental take to be in the form of harm, harassment, and mortality to eggs, fry, juveniles, or adult chinook salmon resulting from each of the following alternative actions:

*Interim Passage is Provided*:

1. Injury or mortality of UWR chinook salmon from entrainment through the Trail Bridge Dam spillway gates or turbine intake.
2. Injury or mortality of rearing juveniles due to stranding along margin habitat upstream of Trail Bridge Dam.
3. Reduced forage base, habitat quality, and habitat quantity for rearing juveniles in the bypass reaches below Smith and Carmen dams due to low flows.
4. Reduced productivity from effects on rearing and spawning habitat quality and quantity below Trail Bridge Dam due to the continued blockage of large wood and sediment from the Carmen-Smith Project.

*Interim Passage is Not Provided*:

1. Reduced productivity due to blocked spawning habitat upstream of Trail Bridge Dam and confinement of spawners to the spawning channel and habitat downstream of Trail Bridge Dam.
2. Reduced productivity from effects to rearing and spawning habitat quality and quantity in the mainstem McKenzie River below Trail Bridge Dam (primarily in the approximately 15-mile reach between Trail Bridge Dam and the confluence of the McKenzie River and Horse Creek) due to the continued blockage of large wood and sediment from the Carmen-Smith Project.

If the proposed action results in take of a greater amount or extent than that described above, FERC would need to reinitate consultation. The authorized take includes only take caused by the proposed action within the action area as defined in this Opinion.

### *9.2 Reasonable and Prudent Measures*

Implementation of the habitat enhancement measures are necessary to minimize incidental take associated with continuing project operation. EWEB's proposed conservation measures to avoid and minimize operation-related incidental take of UWR chinook salmon were included in the BA as part of FERC's proposed action. Many of the conservation measures in the proposed action include timelines associated with the development of study plans, review of study plans by the Services, and completion dates of studies and actions. These dates were developed by staff from EWEB, FERC, and the Services during development of the proposed action and subsequent BA. The date associated with the annual reporting requirement (described in term and condition #2 below) is in addition to the dates associated with each conservation measure in the proposed action.

NOAA Fisheries has determined the following reasonable and prudents measures (RPM) are necessary to minimize incidental take of UWR chinook salmon:

1. Minimize the likelihood of incidental take of UWR chinook salmon from construction and operation of an interim fish passage facility.

2. Monitor the effectiveness of the EWEB's proposed conservation measures (including habitat enhancement actions and studies) in minimizing incidental take and report the results to NOAA Fisheries.

### *9.3 Terms and Conditions*

In order to be exempt from the prohibitions of Section 9 of the ESA, EWEB must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

To implement RPM #1 (fish passage facility design), FERC shall require the following of EWEB:

1. If an interim fish passage facility is constructed, the design shall be developed in collaboration with NOAA Fisheries, with initial design concepts and parameters based on criteria from the Draft Upstream Fish Passage Facility Criteria, available on NOAA Fisheries' website. The final design shall be approved in writing by NOAA Fisheries.

To implement RPM #2, FERC shall require that EWEB:

2. Prepare annual progress and final project reports documenting the implementation of, and compliance with, habitat enhancement projects and studies proposed in the BA as EWEB's proposed conservation measures (FERC 2003). Annual reports shall be provided to NOAA Fisheries by February 1 of each year, for each conservation measure, and these should continue through the completion of each study, and if applicable, implementation of actions resulting from the studies. The annual reports should be sent to the NOAA Fisheries at the address below:

NOAA Fisheries
Hydropower Division
Attn: Mindy Simmons
525 NE Oregon Street Suite 500
Portland, Oregon 97232

If a dead, injured, or sick UWR chinook salmon is found during the implementation of the proposed action, initial notification must be made to the NOAA Fisheries' Law Enforcement office, located at the Vancouver Field Office, 600 Maritime Suite 130, Vancouver, WA 98661; phone 360-418-4246. Care must be taken in handling sick or injured fish to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state. In conjunction with the care of sick or injured chinook salmon, or the preservation of biological materials from a dead chinook salmon, the finder has the responsibility to carry out instructions issued by the Division of Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

## 10. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. In order for NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NOAA Fisheries requests notification of the implementation of any of the following conservation recommendations:

1. Determine the effectiveness of the velocity barrier below Trail Bridge Dam. In the fall of 2002, adult chinook salmon and bull trout were observed by USFS personnel above the velocity barrier in the tailrace below Trail Bridge Dam, which was previously thought to be impassable. There is no immediate method of determining whether fish observed above the velocity barrier came from upstream or downstream. Thus, in cooperation with ODFW, USFS, NOAA Fisheries, and USFWS, FERC should direct EWEB to initiate a program to determine the effectiveness of the velocity barrier. This program would include surveying for presence of adult chinook salmon in the reach between the velocity barrier and Trail Bridge Dam.

2. Develop and implement a study plan to determine mortality rates of chinook salmon (i.e., experimental hatchery-origin fish) entrained through the Smith Dam power tunnel and turbine in order to provide data for passage-related discussions during impending relicensing.

3. Conduct experimental flow analysis below Carmen Dam to determine the effect of minimum flow releases on overall flow, temperature, and habitat conditions in the McKenzie River bypass reach below Tamolitch Falls.

4. Initiate a monitoring and reporting program to document the number of days and time of year spill occurs at Trail Bridge Dam. Monitor and document UWR chinook salmon that may have been entrained during and after spill episodes by snorkeling the reach between Trail Bridge Dam and the velocity barrier.

5. Pursue Federal or non-Federal funding opportunities for additional habitat restoration within and downstream of the Carmen-Smith Project.

## 11. REINITIATION OF CONSULTATION

This concludes formal consultation on these actions in accordance with 50 CFR 402.14(b)(1). As provided in 50 CFR 402.16, reinitiation of consultation is required: 1) if the amount or extent of incidental take is exceeded, 2) if the action is modified in a way that causes an effect on the listed species that was not previously considered in the BA and this Opinion, 3) if new information or project monitoring reveals effects of the action that may affect the listed species in a way not previously considered, or 4) if a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

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# 13. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

## *13.1 Background*

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

1. Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).

2. NOAA Fisheries must provide conservation recommendations for any Federal or State action that would adversely affect EFH (§305(b)(4)(A)).

3. Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries' EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH, waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species fecundity), site-specific, or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objective of this EFH consultation is to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

## *13.2 Identification of EFH*

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Federally-managed Pacific salmon: chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), and Puget Sound pink salmon (*O. gorbuscha*) (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable manmade barriers (as identified by PFMC 1999), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects to these species' EFH from the proposed action is based, in part, on this information. The McKenzie and Smith rivers, including the river upstream of the Carmen-Smith Project is designated EFH for chinook salmon.

## *13.3 Proposed Action*

The proposed action and action area are described in Chapter 3 of this Opinion. The action area includes habitats that have been designated as EFH for various life-history stages of chinook salmon.

## *13.4 Effects of the Proposed Action*

As described in detail in section 6.2 of this Opinion, the proposed action may result in short- and long-term adverse effects on a variety of habitat parameters. These adverse effects are summarized below:

If interim passage is not provided, the Carmen-Smith Project would continue to block access to 7 miles of historical spawning and rearing habitat (limiting spawning to the spawning channel), and continue to disrupt large wood and sediment transport downstream of Trail Bridge Dam, which would adversely affect adult holding and juvenile rearing habitat. EWEB proposes to improve conditions within the spawning channel and enhance holding and rearing habitat in the McKenzie River downstream of Trail Bridge Dam through side-channel reclamation and enhancement.

If interim passage is provided, then UWR chinook salmon would have access to 7 additional miles of historical habitat. While the Carmen-Smith Project would adversely effect UWR chinook salmon if they are passed upstream of Trail Bridge Dam (injury and mortality causes by entrainment in the turbine intake or spillway gate, stranding, predation, etc.), the magnitude of these effects are currently unknown. However, FERC proposes that EWEB complete studies during relicensing that would define these effects, and the results of those studies would be incorporated into NOAA Fisheries' decision to direct EWEB to pass UWR chinook salmon upstream of Trail Bridge Reservoir during the interim. EWEB also proposes to implement habitat restoration project upstream of Trail Bridge Dam, which would improve the likelifhood of successful spawning and rearing above Trail Bridge Dam.

### *13.5 Conclusion*

NOAA Fisheries concludes that the proposed action would adversely affect designated EFH for chinook salmon.

### *13.6 EFH Conservation Recommendations*

Pursuant to Section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which adversely affect EFH. While already included in FERC proposed action, NOAA Fisheries reiterates that FERC will require EWEB to implement the the following conservation measures to address the adverse effects described in section 13.4:

1. Enhance holding, spawning and rearing habitat downstream of Trail Bridge Dam by reclaiming and improving side channel habitat.

2. Supplement the spawning channel with gravel to increase its capacity and effectiveness.

3. Enhance spawning and rearing habitat upstream of Trail Bridge Dam by adding large wood to the McKenzie River (this measure would only benefit chinook salmon if EWEB passes chinook salmon above Trail Bridge Dam).

While NOAA Fisheries understands that the conservation measures described in the BA will be implemented by the action agency, it does not believe that these measures are sufficient to address the adverse impacts to EFH described above. However, the terms and conditions outlined in Section 9.3 are generally applicable to designated EFH for chinook salmon, and address these adverse effects. Consequently, NOAA Fisheries recommends that they also be adopted as EFH conservation measures. These conservation measures are:

1. Prepare annual progress and final project reports documenting the implementation of, and compliance with, the two conservation measures proposed in the BA that involve habitat enhancement projects (FERC 2003). Annual reports shall be provided to the NOAA Fisheries by February 1 of each year, for each conservation measure, and these should continue through the completion of each study, and if applicable, implementation of actions resulting from the studies. The annual reports should be sent to the NOAA Fisheries at the address below:

NOAA Fisheries
Hydropower Division
Attn: Mindy Simmons
525 NE Oregon Street Suite 500
Portland, Oregon 97232

2. If an interim fish passage facility is constructed, the design shall be developed in collaboration with NOAA Fisheries, with initial design concepts and parameters generally based on criteria from the Draft Upstream Fish Passage Facility Criteria, available on NOAA Fisheries' website. The final design shall be approved in writing by NOAA Fisheries.

### *13.7 Statutory Response Requirement*

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

### *13.8 Supplemental Consultation*

FERC must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(k)).

### *13.9 References*

PFMC (Pacific Fishery Management Council). 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Portland, Oregon.